International PROJECTIONIST

Edited by James J. Finn

Vol. 1, No. 1
October, 1931

A magazine devoted to better visual and sound reproduction

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To Jim Finn:

Projectionists of the Home Office and of the Greater New York theatres of Publix Theatres Corporation are glad of this opportunity to express their appreciation of your splendid work in the advancement of motion picture projection generally and in behalf of the projectionist particularly. Publix Theatres projectionists extend to you their hearty good wishes for success.

Publix Theatres Projection Department

HARRY RUBIN

Director of Projection, Publix Theatres Corporation

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International PROJECTIONIST

Edited by *James J. Finn*

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MONTHLY CHAT

THOSE buyers who are patting themselves on the back for the reason that they have successfully avoided buying new equipment or incurred any expense even for repairs for many months back are heading for a fall—and a steep one. A theatre projection room cannot operate efficiently with defective or worn equipment, and if it is being operated under these conditions, the bill will be twice as much some-odd weeks or days or months from now than it would be if the proper action were to be taken now.

That projector mechanism that is humming so steadily today may knock and grind and tear itself to pieces tomorrow—and the results will knock the pocketbook harder if the mechanism should decide to quit during a show. Projectionists have no greater responsibility than to see that equipments are not permitted to run themselves into such condition that a repair job is out of the question. Most of the penny-wise buyers will shortly face a day of reckoning—and what a day it will be!

A nominal expenditure of ten-, twenty-, or thirty-odd dollars of today, if left unspent, can multiply itself into an expense of several hundreds of dollars within a few weeks. And within a few weeks the buck will be passed directly to you, the projectionist, whose job it is to see that such occurrences do not come about.

Western Electric is reported to have gone after the matter of replacing storage batteries in earnest. Report further has it that in the process of getting "het up" on the subject, W.E. is considering the following alternatives: (1) a special rectifier; (2) coarse filaments which will not respond appreciably to A.C. cycle fluctuations, and/or (3) a special optical system which will permit the use of the regulation filament.

We will believe in No. 3 if and when we see it (although rumor has it that a Rochester optical company promises to do the trick); and No. 2, which we bellowed about two years ago, further complicates the matter of effective light beam concentration. We like to think of No. 1 as the answer not only because it appears to solve the problem most satisfactorily, but also because a question about it nets only blank looks among W.E. men.

The A.F. of L. pow-wow at Vancouver in early October will take a vigorous stand for the five-day week. This is fine, and everybody is for it. The fly in the ointment will be Labor's demand for five and one-half days' pay for five days' work. *Some* fly. J. J. F.

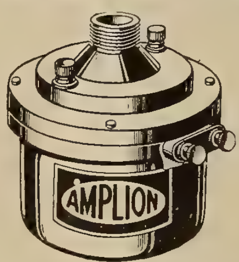
ANNOUNCING

the NEW Amplion

OCTOPHASE

heavy-duty dynamic unit

Employing the dynamic principle invented by Sir Oliver Lodge, the principle of the Piston Diaphragm taught by Edison, Stroh, Cooms, and others, and the principles of sound chamber design contributed by Eichmeyer, Taintor, Tigerstedt, etc., this unit has a truly brilliant line of antecedents. It would not have been possible without the contribution of these great investigators. It is the contribution of Amplion engineers, working with modern facilities, however, coupled with the experience of the past that has given this unit unprecedented efficiency, wide frequency range, and capacity to reproduce tremendous volume with a clarity and tone quality not heretofore equalled.



LEGEND:

In the Octophase, the area above a scientifically domed piston diaphragm of great rigidity but extreme lightness, is divided into eight divisions with three sections in each division, twenty-four sections in all. Channel ways are provided for conveying the sound impulses from these twenty-four sections to the throat of the horn. Space and time relations are so designed that the impulses from each space reach the throat of the horn at the same moment in perfect synchronism. By means of this construction, there is realized great efficiency, greater frequency range and the ability to reproduce tremendous volume without blasting. Music is reproduced in its full range and speech is reproduced with a finesse that retains every shade of human emotion. From these eight divisions, OCTOPHASE derives its name.

The efficiency of this unit is from six to eight hundred per cent greater than that of cone speakers, and is the equivalent of an extra stage of amplification. High sound levels are obtained with less amplification permitting the operating of amplifiers below distortion levels, improving the quality and increasing tube life.

Other Amplion Products Are

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Sound System Apparatus

WRITE FOR FOLDER DESCRIBING UNIT AND ACOUSTIC HORNS

AMPLION PRODUCTS CORPORATION

38 WEST 21st STREET NEW YORK CITY

Merely printing technical data does not justify the existence of a publication purporting to serve a craft. Technical data—yes; but also craft news, a sympathetic understanding of the craftsman's needs at work and away from work, and a constant vigilance to herald and to fight any danger to either his welfare or his work—such a service marks the true craft paper.

INTERNATIONAL PROJECTIONIST will eassy this service—and will endeavor to attain at least this mark by trying to do more. This is our dedication.

JAMES J. FINN

INTERNATIONAL ALLIANCE OF THEATRICAL STAGE EMPLOYES AND MOVING PICTURE MACHINE OPERATORS OF THE UNITED STATES AND CANADA, 1450 BROADWAY, NEW YORK CITY, N. Y.

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New York, N. Y.,
August 5, 1931.

Mr. James J. Finn,
International Projectionist,
1 West 47th Street,
New York City.

Dear Mr. Finn:

I desire to be among the first to extend to you my every good wish for the success of your enterprise.

Your work during the past five years in the interests of motion picture projectionists has been of an extremely high order and has earned for you the esteem of the entire craft. The experience thus gained, plus a wide knowledge of the projection field and your oft-demonstrated appreciation of the problems of the projectionist, eminently qualify you for the work which you have elected.

I am sure that these personal qualities will be reflected in a splendid publication which will gain the support of all projectionists.

Be assured of my continued interest in your progress.

Sincerely yours,

Wm. F. Canavan
International President.

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INTERNATIONAL PROJECTIONIST

VOLUME I NUMBER 1

OCTOBER 1931

PRACTICAL HINTS ON EVERYDAY PROJECTION PROBLEMS

Harry Rubin

DIRECTOR OF PROJECTION, PUBLIX THEATRES CORPORATION

PICTURES should be projected without vibration, and should be sufficiently — and evenly — illuminated, without brown corners or dark centers. The draw curtains should close in exact time with the ending of each film, the music properly finished on final note. At the beginning of each subject the title should show on closed curtains which are then immediately opened. A blank screen should be *carefully avoided.*

The importance of careful timing, in this work should be strongly emphasized because it is this exactness which adds greatly to the effectiveness of the program. As one of the audience, you should not be able to distinguish the various change-overs between reels in a multiple reel subject. Both the picture and sound change-overs should be smoothly made.

Any one of the foregoing faults mentioned, if seen on your screen, indicates possible defects in your projection.

Screen Illumination

For instance, vibration may be caused by insufficient tension, shrunken film, loops which are too short, emulsion deposits in film traps or tension springs, bent intermittent shaft, bent sprocket or teeth, accumulated dirt on face of intermittent sprocket, or by transmitted vibration from motor or movietone attachment, by unstable projector base or projection room floor. A careful check should be made to determine the origin of the vibration.

The amount of illumination depends upon:

The type of arc used.

The make of carbons.

The current consumed at the arc.

The setting of carbons.

The width of shutter blades.

Diameter of condensers—Lenses and reflectors.

Condition of condensers—Lenses and reflectors.

The optical line-up.

The length of throw and size of picture.

Obviously the projectionist does not have control over all of these factors, but if he shows an interest in his work, he can assist materially in maintaining screen illumination at a maximum value.

Even illumination is obtained by having the proper optical line-up of the arc, the condensers, reflectors and objective lenses, also by carrying a sufficiently large spot on the aperture to avoid brown corners on screen.

Defective carbons may vary in composition or structure, or may chip off, or have faulty cores, all of which results in uneven illumination. Constant attention of the projectionist during the burning of the carbons is necessary, in order to maintain a proper adjustment of the arc.

Proper Change-Overs

Poor change-overs may be caused by film being missing from ends of reels—this will eliminate a portion of the sound if film-recorded; by projectionist taking the wrong cues to start motor or on film change-over; by throwing the fader over too soon or too late; by failing to take the proper number of "turns down" before starting; by slow pick-up of incoming projector, or by improper working of change-over shutter.

Poor change-over, starting out of focus or out of frame, destroy the illusion which is being created by the picture and distract the attention of the patrons. Interruptions of any nature reduce the entertainment value of the picture.

Inspection Routine

To prevent interruptions or reduce them to the minimum and to insure good projection, all film should be inspected for loose splices and other defects before projection. All projectors, lamps, and sound equipment should be regularly and systematically cleaned and inspected.

This inspection should determine if the proper tensions and adjustments are maintained throughout the projector mechanisms. If tension of the film is too tight, the film is likely to break; if idler rollers are not properly adjusted, the film will run off sprockets or loose

Harry Rubin

loops and break. Inspection of lamps is necessary to see if insulated parts and all working parts are in perfect condition.

Maintaining the proper clearances of pad rollers, fire valve rollers and film trap, and the proper tension on pressure pads and the take-up will (1) extend the life of the mechanism parts; (2) lessen the liability to film fires; (3) conduce to best screen results; (4) reduce wear and injury to film, thereby effecting a tremendous saving.

Defective Reels

Avoiding the use of bent reels will prevent damage to film while in theatre. Inspection and cleaning of mechanism after each reel prevent accumulations of emulsion causing damage to subsequent reels. Inspection of film after each run will detect loose splices, scratches, or other defects, which may have developed during last run of film.

Careful handling of amplifiers is allowing sufficient warming up time for tubes, prevention of excessive current in tubes, and when closing down, opening high voltage circuits before low voltage ones, will prolong the life of tubes.

The proper level of sound must be maintained on each subject, and in order to do this, it is necessary that the projectors be periodically tested for equal volume.

Spare Parts Stock

All parts which show wear should be replaced and repairs made without delay. The spare parts should be kept on hand and replacements anticipated. A careful checking of spare parts at frequent stated periods against sudden shortage of vital equipment or supplies will eliminate expense of special ordering or shipping. Duplicates of parts subject to sudden breakage should be readily available in case of emergency.

Using manufacturers' code number to designate part ordered wherever possible insures that correct article is received in the first instance.

Using stage horns at high volume behind closed front curtains invites injury to the horn receivers. Repairs cost $20 per receiver. Careful projectionists guard against this trouble by keeping volume within limits of receiver.

Systematized Work

Cleanliness, neatness, orderliness, and systematized work in the projection room are absolutely essential. Since the coming of the sound picture, cleanliness has become particularly important in the projection room. It is literally possible for dirt to be heard as well as seen. Sound reproducing mechanism is so delicate and sensitive that it can pick up the smallest speck of dust and transmit it in the form of distorted sound to your audience.

The sound can be interrupted—or entirely killed—through an extremely small speck of dirt which may block the transmitted light beams from the exciting lamp or may cause imperfect contacts at hundreds of points in the sound equipment.

Dirt deposited in the aperture of the projector will show on the screen and divert the attention of the audience. This deposit may be caused by:

1. Dirt picked up on the film through contact with the floor.
2. Dirty projection.
3. Dirty film containers.
4. Lint from cloth used in cleaning film.

The careful projectionist will keep the film in a clean condition and keep excess oil from projector, as he knows that oily film attracts dirt and that the oil spots on film show upon the screen; also, oily film affects the quality of the sound.

Orderliness demands that all spare parts—kept on hand for use and emergencies—be instantly available when needed. Thus delays, if occasioned at all by breakdowns, will be remedied immediately, or with the least possible delay. For example, an exciting lamp is a very small but very important item. To properly perform its work, it must be placed in the projector and accurately positioned in its holder. In the event of an exciting lamp burning out under proper conditions, it is but a few seconds work to extract this lamp with its holder and insert another lamp and holder, which has been previously focused for this projector.

No two projectors seem to have identical focus, and, therefore, each holder should be properly marked and placed near the projector upon which it is to be used. This may appear to be a trifling matter but it will shorten the delay to a few seconds should the exciting lamp burn out during the show.

Managerial Cooperation

The manager who uses good judgment can establish a cooperative spirit which will produce excellent results and maintain friendly relations between the management and the projection staffs. Where several men are employed in sound projection it is necessary that there be a full understanding between these men as to the work which each is to perform. They should arrange this in advance so that a smooth performance will be secured. Without such understanding, some of the work may be neglected or more than one man may attempt to do the same work.

The manager should see to it that there is a full and complete check-up of the projectors and sound equipment every day before the start of the show and also a separate check of each horn unit.

Pre-Show Preparation

If the manager has an effect machine and magnascope screen, he should use the positive and negative effect designs to dress up his short subjects, seasonal and advance trailers, overture films, organ solos, and introductory titles of features.

These positive and negative effect designs have become a distinctive feature of the high type of entertainment offered in the Publix Theatres. There are, at the present time, approximately 300 of these designs which were originated and created under my supervision. Many artists were employed in the making of them in order to obtain variety—and originality—of ideas and designs. Inasmuch as positive and negative designs are simply combinations of black and white with various shades of gray, the colors are obtained by means of colored gelatines. Considerable thought and experimentation was required before the

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HARRY RUBIN SAYS:

"CLEANLINESS, neatness, orderliness, and systematized work are absolutely necessary in the modern projection room. . . . It is literally possible for dirt to be heard as well as seen. Sound producing mechanism is so delicate and sensitive that it can pick-up the smallest speck of dust and transmit in the form of distorted sound to your audience.

"The manager who uses good judgment can establish a cooperative spirit which will produce excellent results and maintain friendly relations between the management and the projection staff. Where several men are employed on a sound projection shift, it is necessary that there be a complete understanding between the men as to the work which each is to perform. Without such an understanding, some of the work may be neglected as a result of 'letting the other fellow do it', or several men may attempt to do the same work."

proper balancing of light and shade was obtained which would give the desired effect when combined with color.

Machines for showing these designs have been improved at our suggestion so that an effect may be kept on as long s desired without breakage and so that exact registration of positive and negative designs can be quickly made. The Projection Department has issued advice sheets describing those designs and explaining how each was used on which film or other subject, what color combinations were employed, also other suitable colors which might be used if desired, how masked off and what other effects were used in conjunction, also suggestions for the future use of each design.

Use of Magnascope

With the magnascope screen the manager should carefully select the weekly subjects or portions of his feature for such magnascope use. The opening of magnascope creates the illusion of gradual enlargement and, therefore, magnascope should never begin with a title—with this exception:—when the draw curtains are opened on a magnascope screen as at the beginning of a subject. When going from small picture to magnascope an appropriate scene must be chosen which conveys spaciousness and secures the best results. Where movable magnascope masking is employed it should move smoothly and accurately to position for both magnascope and small picture. Accuracy is required to prevent an excessive overlap of picture on the masking or, on the other hand, to avoid showing blank screen around the picture.

The best illusion with sound pictures is obtained when the bottom of the picture is as close to the stage as sight lines will permit. This point should be observed, because sound pictures are really plays, and the players appear more natural when on the level of the stage.

Correct Picture Size

The size of the picture deserves consideration. The size will largely depend on:

1. Sight lines.
2. Distance between the screen and the furthermost seats, and viewing angles.

It is not possible to obtain an ideal size for all parts of the theatre, but an average can be found which will be satisfactory. The picture should be of sufficient size so that the features of the players are easily distinguished from the farthermost seats. The proper type of screen for a wide theatre is one having a diffusive surface. This surface reflects light to the side seats almost as well as to those in the center. A highly reflective surface gives most reflection within a narrow angle, and consequently should be used only in theatres where the projection and viewing angles are small.

Care of Batteries

Attention given to storage batteries in the matter of maintaining proper level of electralyte and the avoidance of over-charging or over-discharging will result in a full, useful life. and, conversely, a lack of such attention will result in a greatly shortened life, with consequent waste and expense. Failure to keep battery plates covered with electrolyte results in permanent injury to those portions of the plates which are left exposed.

Over-charging results in the rapid formation of sediment which soon short-circuits the cells, and is also wasteful in the use of current. When it is frequently necessary to add much water to battery, it may be taken as an indication that batteries are being over-charged.

Lubricate Frequently

Regular and frequent lubrication has a direct relation to the life of the projector mechanism. Oil should be sparingly applied to bearings, and any excess wiped off before projecting film. Absorbent pads should be changed frequently, as this will prevent oil soaking into the film amplifier, causing damage to insulation of wires, and also will prevent the accumulation of oil on film.

Photographic Problems the Solution of Which Would Materially Aid Reproduction

Lewis W. Physioc

SOUND pictures have greatly affected motion picture photography. The reasons are all very apparent. The cameraman no longer has that freedom and range of activity he enjoyed previously. He has had to make the best of the sound-proof booth and the various other camera covers. They have enveloped his individuality and his artistry in a mattress. They restrain the individual management of the camera.

There is a very unsatisfactory feeling in having to shoot through heavy plate glass, with its problems of refraction and reflection, personal discomfort, the difficulties of lining up sets and focusing or following focus during the moving shots that seem to have become so popular. Many inquiries have been made as to which type of blimp is most satisfactory. There are no satisfactory blimps. This is the one thing that has taken all the joy out of the cameraman's profession. Indeed, there is little improvement in the "blimp" over the "dog house" (booth), of the earlier days of the talkers.

In the booth the disadvantages, as before mentioned, were personal discomfort, shooting through the mediums and the difficulties of focusing, etc., all of which prohibit those little intimacies between the camera and its master.

The Aperture: The present picture dimensions are a source of great worriment to the artist. It is very difficult to frame a pretty picture in the present awkward proportions. Vignetting and other individual effects are prohibited by these limited areas and proportions.

Projection apertures are not standardized and the cameraman is never sure of his frame. We frequently see the tops of the heads cut off, people partly out of the picture and other awkward instances of framing. We realize the tremendous cost of providing a new aperture, but the present one is certainly unsatisfactory. Even when matted down to the original shape there are many disadvantages, chief among which is the increase of grain by further enlargement. Here, indeed, is another make-shift. Let us realize that if we *must* make talking pictures, let us make them right.

Criticism: What we need very badly is honest, intelligent, constructive criticism. There is nothing so stimulating as criticism—not the caustic, controversial idea so common among reviewers, but competent, analytical disquisitions. We have very little of this.

A picture is either a "knock-out" or a "flop": the photography is either good or bad, dull or clear. We want to know *why* a thing is good or bad. We want to know what to avoid and what to enlarge upon.

Some of us may not relish a criticism of our work, but secretly we will profit by it, for the real student will gather from every source.

SOUND SYSTEM NO BETTER THAN HORN AND RECEIVER UNITS

J. Henry Schroeder

IN order to obtain efficiency, a sound reproducing system as a whole must exhibit an even response to all frequencies within the audible range. In no element of the system is this need more pressing than in the speaker, or horn, units, which must meet such requirements to enable the whole system to produce the desired results.

The design of receivers and horns is a matter which has received a considerable amount of attention at the Bell Laboratories, and the result of these attentions is found in the 555-W receiver and the 16- or 17-type horns.

What Is a Receiver?

The receiver is a unit which is employed to convert electrical energy into sound energy. The electrical energy is in the form of an alternating current, while sound is a degree of mechanical energy in the form of compressions and rarefactions in the air. It is a simple matter to produce sound energy by moving a diaphragm. It is known now that a conductor carrying a current will tend to move if placed in a magnetic field. Therefore, a coil carrying the electrical energy or speech currents is fixed to the diaphragm and situated in the magnetic field between the pole pieces of a field winding.

As the speech current is alternating, the movements of the diaphragm will be of an alternating nature. In addition, the frequency of movement of the diaphragm will correspond exactly with the frequency of the speech current, and its displacement will be proportional to the value of this speech current. Thus it is possible to convert, faithfully, the electrical energy into a mechanical form.

Number of Receivers

A theatre installation contains one or more receivers depending upon its size. There may be one or two receivers per horn, according to whether a 17-A, 17-B, 16-A or 16-B horn is used, which, in turn, depends upon the size of the installation.

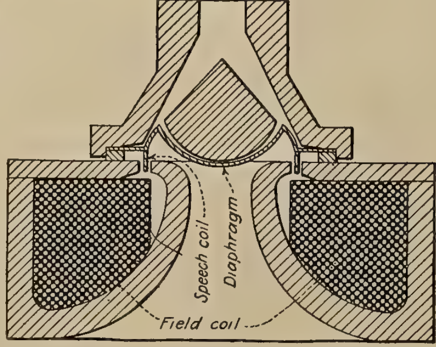
The 555-W receiver has a diaphragm made of duralumin 0.002 inch thick. This diaphragm has its central portion cupped, which gives it considerable stiffness and causes it to move against the air column with a motion similar to that of a plunger. An ordinary flat diaphragm flexes throughout, and the amount of movement is much greater at the center than nearer the edge. The diaphragm of the 555-W receiver flexes only near its outer edge, giving considerably better results than the flat type.

The speech winding comprises a coil of edgewise wound aluminum ribbon attached to the diaphragm, and situated between the pole tips of the field winding. The field winding derives its power from the "H" batteries, consuming 1.5 amps at 7 volts. The speech winding has a high carrying capacity in comparison to its weight, due to its single layer construction and small amount of insulating material, resulting in a high rate of heat dissipation.

The Tone Chamber

Immediately in front of the diaphragm is an air space or tone chamber which has to be very carefully designed. The sound radiating efficiency of the horn type of loud speaker may be limited due to interference between air waves as they pass through the chamber between the diaphragm and the throat of the horn. In many types of loud speaker, the dimensions of this chamber are comparable with wave lengths of sound within the audible range. To avoid this, and the resultant irregularities in the frequency response, the tone chamber in the 555-W receiver is constructed so that no serious distortion of sound can occur within the useful range of the wave length.

An exceptionally high efficiency is obtained by using this specially constructed tone chamber and the plunger-like motion of the diaphragm. The efficiency of the unit, for converting power from that of electricity to that of sound, is as high as 50 per cent. When this is compared with the one per cent efficiency of the average loud speaker, the advances made in this field can be readily appreciated.



Drawing showing components of W. E. 555-W receiver

Importance of Connections

It is very important to make sure that the connections on all the receivers are made the same way. If a pair of wires are reversed on a receiver, it will mean that either the excitation current or the speech current will flow in the opposite direction in that receiver relative to the others. This will mean that the diaphragm of the wrongly wired receiver will be moving in the opposite direction to the diaphragms of the other receivers. In other words, when one diaphragm is compressing the air, the other is creating a vacuum, with the result that one effect neutralizes the other. If the two receivers of one horn are wired in opposition, theoretically, no sound will be heard from the horn. Such an occurrence, even if the receivers are on different horns, will result in the sound distribution being ruined.

Some Don'ts

If for any reason, such as a blown fuse, there is no field current, very faint sound will be heard. This is due to the residual magnetism left in the poles of the field. Never operate a receiver except in connection with a horn. The horn provides a long column of air which acts as a load on the diaphragm and prevents it from vibrating so violently as to burst, as it would do if used without a horn. In this respect, never raise the fader all out in order to play an exit march through the curtains, or increase the volume for gun shots, etc. Such practice will sooner or later—usually sooner—result in broken diaphragms.

Purpose of the Horn

The purpose of the horn is to afford a coupling between the receiver unit and the outside air, causing the sound energy, produced at the unit, to be properly radiated into the theatre. The diaphragm of the receiver will vibrate to the point of self-destruction without delivering any real amount of sound energy, and it is only by loading it with an air column that we can obtain the desired results.

The air column must be small in area at the input end to place an appreciable pressure load on the diaphragm, and it must be large at the other end to radiate

the sound effectively into the free air. For best results the cross sectional area should gradually flare from the small end to the large end, according to an exponential mathematical formula, hence the name of "exponential" horn. In order to effectively handle low notes, the length of the air column must be over half the wave-length of the sound. The 15-type horns have air columns about 14 feet long and are curved for economy of space.

Proper Positioning

To obtain the maximum amount of realism, the horns are positioned behind the screen and about one-third down from the top of the picture. On an average, the mouth of anyone speaking on the screen is at this position. Different theatres vary enormously with regard to their acoustical qualities, and to obtain the best distribution of sound in all theatres, it is necessary to deal with each case separately.

The flare and tilt of horns are carefully determined by Western Electric engineers, and under no circumstances should they be altered. Expert acoustical engineers visit each theatre immediately after installation and then periodically, in order to ascertain, together with other items, if the quality of reproduction and the distribution is up to the standard called for by Western Electric.

In replacing the horns after they have been moved, be sure to get them back in position exactly as located by the engineers. In order to do this it is advisable to have positioning pins dropping through a portion of the horn towers into holes in the stage. Even a movement of an inch or so from the correct position may result in uneven distribution, and in some theatres, interference of the sound or echoes may be encountered.

NEW USE FOR SOUND FILMS

A recent report states that novel evidence, which may have far-reaching effect, is being tendered in a trial in Melbourne, in which a dairy company is being sued for damages because of loud noises which continually disturb the sleep of the plaintiff in the action. A sound recording company was engaged by the plaintiff to record the disturbing noises, and the sound reproduction is to be shown as evidence when the case is tried. Some question arose regarding sound distortion, and the fact that if the film was reproduced in a room the sound would be magnified. The judge is reported to have stated that he would hear the reproduction and form his own opinions.

In obtaining the record, a microphone was placed a few inches from the windowsill of the plaintiff's bedroom, and the record was taken, including the reproduction of an ordinary voice for purposes of comparison.

ALLIANCE ITEMS

Illinois State Organization Meets

THE State Organization of Projectionists convened at Galesburg, Ill., September 14th, at which time the locals represented decided on an increase in per capita tax, a certain percentage of which sum will apply ot the legislative fund, created in an endeavor to have certain measures and bills introduced at the next session of Congress. The local unions affected fully appreciate the recompense should their efforts meet with success, and are overlooking no possible aid to accomplish their end.

Important Work by Florida Council

ALL local unions in the State of Florida, with one exception, had proper representation at the meeting of the Florida State Council, held in Tampa, Fla., which was devoted to the discussion of new contracts. Measure was voted upon and passed whereby this body shall be known as above captioned, and will continue to hold periodical meetings.

A great deal of time was spent debating on legislation which would be of material benefit to the various local organizations, and it is anticipated that good results will be obtained from the combined efforts of the locals working as a unit.

New I. A. Local at Nanty Glo, Pa.

INVESTIGATION of charter application for Nanty Glo, Pa., revealed that all requirements specified by the International Constitution and By-Laws had been complied with. Therefore, proper obligation of members, installation of officers and charter was performed by Secretary Lawrence Katz of the Fourth District, and constructive information and advice was given for the successful conduction of the affairs of the new organization.

Any Amplifier Equipment Requires I. A. Man

ON several occasions it has been called to the attention of the General Office that traveling companies have been moving about the country carrying amplifiers, etc., and getting by our local unions without having placed a member of our Alliance. Naturally, when they arrive at the next stand and are informed of the International requirements, they relate the position maintained at the preceding point and strenuously protest, feeling that they are being imposed upon.

Indifference, neglect or unfamiliarity with the International By-Laws may be responsible for this condition, which was brought to the attention of the Delegates at the Thirtieth Convention in Los Angeles, in the form of Resolution No. 13, which was unanimously adopted. As this type of attraction appears to be increasing in number with the advent of the new season, special attention should be brought to bear in an endeavor to strictly enforce the requirements.

Resolution No. 13 is herewith reprinted:

To the Officers and Delegates of the 30th Biennial Convention of the I. A. T. S. E. & M. P. M. O. of the United and Canada:

BE IT RESOLVED, That Article 5, Section 4, Page 55 of the By-Laws, which reads as follows:

"Any vaudeville act carrying stereopticons, spot, flood or effect lamps (such as waterfall, fire, cloud, lightning effects, etc.) or sufficient other electrical apparatus, shall be required to employ a member of this Alliance to care for and operate such squipment," be changed to read as follows:

"Any vaudeville act carrying public address machines, practical radio sets, amplifying equipment, television apparatus, stereopticons, spot, flood or effect lamps (such as waterfall, fire, cloud, lightning effects, etc.) or sufficient other electrical apparatus, shall be required to employ a member of the Alliance to care for and operate such equipment."

Tenth District Meets in Syracuse

A THREE-DAY Convention of the Tenth District, which is comprised of all local unions in the State of New York, was held in Syracuse, N. Y., recently. A keen interest was displayed by the attending delegates and many questions of mutual interest were discussed. The problem of dual organizations received considerable attention, and the District went on record to assist any local within the District who found themselves troubled by such organizations.

I. A. Executive Board Meets at Vancouver

IN accordance with the usual custom, the General Executive Board of the International Alliance of Theatrical Stage Employes and Moving Picture Machine Operators of the United States and Canada held sessions in conjunction with attendance at the American Federation of Labor Convention, which convened at the Vancouver Hotel, Vancouver, B. C., on Monday, October 5th, 1931. All Charges and Appeal cases handled by the General Office subsequent to the General Executive Board meeting of last July, were submitted to the Board for consideration, as well as all other matters requiring immediate attention.

A. P. S. REORGANIZATION PROBLEM AWAITS DECEMBER ELECTION

NEGOTIATION between West Coast chapters and the Supreme Chapter (N. Y.), of the American Projection Society looking toward a settlement of the matter of reorganization, proposed by the former group, has been suspended, it has been learned from a usually well-informed source. Report has it that the New York contingent favors letting matters stand as at present until the annual election of officials scheduled to be held in December. The West Coast chapters, on the other hand, desire immediate action so that the affairs of the Society, already seriously disrupted by the talk of reorganization, may be placed in order without further delay.

West Coast chapters have long favored reorganization of the Society but did nothing to bring it about until June of this year when they sponsored a series of meetings held in Los Angeles which resulted in the passage of a resolution citing the "managerial inefficiency" of the Supreme Chapter and calling for reorganization of the Society. This resolution had the approval of the following chapters: No. 7, Los Angeles; 11, Vancouver, B. C.; 12, Oakland; 16, San Francisco; 19, San Bernardino, and the organized but as yet unnumbered chapter in San Diego.

The West Coast group is standing firm on the content of the aforementioned resolution. The New York faction has held several meetings within recent weeks, the last being on October 1, as a result of which they are reported to have decided to make certain "concessions" to the Coast chapters. The nature of these concessions could not be definitely established, but it has been learned that one of them will involve the transfer of publication offices of *The American Projectionist,* official organ of the Society, to the Coast, probably to Los Angeles. Other than this, nothing could be learned except that the New York group is "kindly disposed" toward the Coast chapters and is willing to "cooperate" in "any action looking toward betterment of the Society as a whole;" also that the election of officers in December is "expected to provide the answer to the whole problem of reorganization."

It appears extremely doubtful that the West Coast chapters will regard directorship of *The American Projectionist* as any considerable "concession" to them, and they are expected to press for the right to exercise control over and direction of the Society as a whole. Failing this, it has been intimated, the Coast chapters may consider secession.

It is more or less an open secret that many other chapters of the A.P.S. are in complete agreement with the stand taken by the Coast chapters, and that reorganization of the Society at an early date is earnestly desired—even by those chapters which have heretofore maintained very close relations with the New York group. If the whole matter should eventually come to a "showdown" of votes in a general election, the Coast chapters are expected to win easily. For this reason, say some observers, the New York group is now eager to make certain concessions to forestall certain defeat.

It seems netirely probable that negotiations between New York and Coast chapters designed to reach some amicable agreement on controversial points will be reopened prior to election time in December, so that whatever the outcome of the balloting, a continuation of the Society's activities by all chapters will be insured.

DE FOREST RECEIVES $1,000.000 IN TUBE SUIT SETTLEMENT

C. G. Munn, President of the DeForest Radio Company, announces that the triple damage suit against Radio Corporation of America has been settled by the payment to DeForest of $1,000,000 in cash, and that cross license agreements on tube patents only have been entered into by both companies. This settlement brings to a close the litigation of several years over the so-called Clause 9 of the contract by the RCA with its receiving set patent licensees, whereby said licensees were limited to the use of RCA or RCA licensed radio tubes in their sets. The DeForest Radio Company, as well as other independent radio tube manufacturers, contested the legality of Clause 9, winning a succession of court decisions.

"The settlement of our triple damage suit against the Radio Corporation of America at this time is of far-reaching importance not only to the DeForest Radio Company but to the sound reproduction industry at large," states C. G. Munn. "The settlement has been hastened by the recent decision of the Supreme Court, holding the Langmuir patent invalid. That patent, which has been held as a threat against the radio industry and other industries utilizing the high vacuum tube, is not included in the present settlement. Even if the previous decision should be reversed on the appeal, the DeForest Company would have full rights under the Langmuir patent by virtue of the cross licensing agreement now consumated with RCA.

"The radio public gains by this settlement through having the radio industry concentrate once more on the development and production of new and better radio products, in place of the long litigation which has severely strained the resources and attentions of the contestants during the past few years."

OUT OF FRAME

By Opti Collusion

BELIEVE it or not, a chief projectionist does not project a picture. A chief projectionist should not be confused with a Supervisor of Projection, the difference being that the latter visits the projection room not more than twice a year.

•

Don't bother to take home any samples of grease graphite, boys. It may be all right on take-up chains and as a lubricant for your hi-le, hi-lo lamps, but experience has proven that it is not very good as a toothpaste.

•

. . . and don't take the sound amplifier home after the show. All fight broadcasts terminate at 10.30 p. m.

•

The last time I warmed my lunch in the lamphouse, the soup boiled over and spoiled a perfectly good mirror which up to that time had only one crack.

•

The trouble with the paying patron is that he hasn't sufficient patience to wait until I do a good vulcanizing job on an inner spare tube—between reels, of course.

•

Have you heard from your manager yet regarding how to stretch carbons?

•

Well, in the absence of a 30-amp. fuse, why not three 10's?

•

How to save oil: deposit it in a bank.

•

Film cement is n. g. for patching cracked condensers.

•

If a wall breaks down on a record, build a new wall or dig a new groove.

•

A penknife will work well on this.

Woolworth's tools are unsurpassed for projection work.

•

Vaseline makes a fairly good cup grease. It is not so good as a lens paste.

•

Newspaper, or even tissue in a pinch, will clean any lens. Try it.

•

The next time the "chief" tells you how he would do it, ask him to *demonstrate.*

PROJECTION OPTICS: THREE BASIC LAWS RELATING TO LENSES

Hugo Lateltin

SOME few years ago projection optics was a subject to which the projectionist in the average theatre could devote his serious attention or not, at his discretion, and still not have his work be sub-standard. Optical problems then were comparatively simple: beyond a careful handling of lenses and mirrors while cleaning them and a practical knowledge regarding focusing, little other knowledge on the subject was required in a theatre with the usual equipment of two projectors.

The construction of projection lenses has remained unchanged since the introduction of motion pictures, the Petzval type lens, developed nearly a century ago, having been adhered to until recently. An additional factor in optical problems was the simple construction of lenses permitting their use by projectionists who did not possess any theoretical knowledge of the underlying principles of optics. As a result, a majority of projectionists had simply a "working knowledge" of lenses and it was on this basis that they did their work.

The work of the projectionist, with few exceptions, consists of oft-repeated executions of particular manual operations. True, some of these operations are rather complicated and require intensive training, but there is not a single phase of projection work which lies beyond the capabalities of the projectionist who manifests an inquisitiveness about every and anything pertaining to his work. While it is true that a projectionist may "get by," as the saying is, with merely a working knowledge of his craft, manual skill alone will not enable him to discharge his duties competently. Investigation and study of the various aspects of his work is needed; and it is really surprising to note the new outlook on the profession of projection that comes with a deep interest in the finer points of the trade.

Today a mere working knowledge of the trade will not suffice. Theatres are equipped with modern optical devices and with effect machines, the proper operation of which demands both a theoretical and practical knowledge. One without the other renders useless either of these qualities. Projectionists should know not merely "how" but also "why." Merely operating a machine without a proper understanding of the principles underlying its operation can hardly be termed a profession.

The operation of an effect machine demands at least a working knowledge of optics. The projectionist should be able, while working on new combinations for a desired effect, to definitely calculate in advance the proper optical arrangements, thus saving himself a great deal of experimental labor and his employer the cost thereof. Apart from these considerations, which are of major importance, the projectionist himself will derive much satisfaction.

It is the purpose of this article not to explain the laws relating to but to cite the underlying principles of optics which are necessary in order to afford the aforementioned working knowledge. We shall explain herein certain fundamentals which may be termed the tools of the trade for the projectionist, insofar as his work is concerned with optics. These fundamentals are:

1. The point to point method which enables one to trace the course of the light rays through the lens. The most simple means of gaining an understanding of the nature of a lens consists of tracing the light rays from a point of the object (aperture, slide, etc.), to its corresponding point on the screen. This is accomplished by using only two rays of light emanating from a particular point.

One ray travels parallel to the optical axis and is deviated by the lens toward the principal focus of the lens; the other ray passes through the exact center of the lens without deviating. The accompanying diagram illustrates the course of two such rays. In addition to the two rays emitted at a point on the aperture, slide, and the like, innumerable other rays pass through every point of the lens and finally merge on the screen at the same point where the two rays previously mentioned came together.

2. The fundamental working knowledge of every projectionist is represented by the formula:

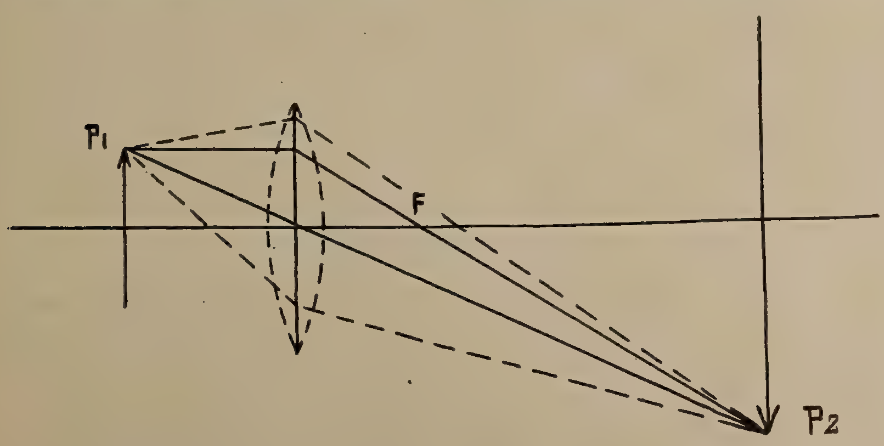
$$\frac{1}{a} + \frac{1}{b} = \frac{1}{f}$$

This formula states that the reciprocal of the distance *a* from the object to the lens, added to the reciprocal of the distance *b* from the lens to the screen, is equal to the reciprocal of the focal length of the lens. With this formula at hand we are able to determine the necessary focus of a lens in order to produce a picture at a certain distance. The focus of a lens depends, according to the above formula, on the distance from object to lens and from lens to screen. These distances depend, on the other hand, on the magnification of a certain objective. This magnification ratio is contained in the following formula:

$$M = \frac{\text{Size of object}}{\text{Size of image}} = \frac{a}{b}$$

3. *M*, representing the ratio of the object (aperture, slide, etc.), to the size of the picture on the screen, is equal to the ratio of the distances *a* and *b*.

In an actual case of determining the focus of a lens, we proceed as follows: First measure the size of the object, and then determine the particular size of picture desired. The ratio between the object and the picture will represent *M*, the magnification ratio. Second, measure the distance from the object to the point where the screen is, or is to be placed.



LEGEND: *F—focus; P_1—a point on the aperture; P_2—a point on the screen.*

This distance is the sum of the distances *a* and *b*, and their lengths are found through the formula

$$M = \frac{a}{b}$$

Insert the length of these distances in the following formula:

$$\frac{a}{1} + \frac{b}{1} = \frac{f}{1}$$

and you will thus be able to find the exact focal length necessary to produce a certain size picture at a certain distance from the object.

This fundamental working knowledge will definitely enable us to cope with optical problems incident to our profession and will lead us to an understanding of the basic nature of the lens. Both will be useful, the first in the practical application, and the second in a heightening of the understanding which leads to a real interest in our profession.

Examples:

No. 1. With a slide which is 3″ high, and at a projection distance of 100 feet, we desire to project a picture 15 feet high. What focal length lens will be necessary?

Given:

Slide height, 3″; picture height, 180″; projection distance, 1,200.″

$$M = \frac{\text{height of slide}}{\text{height of picture}} = \frac{a}{b} \text{ or}$$

$$M = \frac{3}{180} = \frac{a}{1{,}200}$$

$$a = \frac{3 \times 1{,}200}{180} = 20$$

$$\frac{1}{f} = \frac{1}{a} + \frac{1}{b} \text{ or } \frac{1}{f} = \frac{1}{20}$$

$$+ \frac{1}{1{,}200} = \frac{1{,}200 + 20}{24{,}000} = \frac{1{,}220}{24{,}000}$$

$$f = \frac{24{,}000}{1{,}220} = 19.67'', \text{ answer}$$

No. 2. A film is projected through an aperture 0.6″ high at a projection distance of 100 feet, and we desire to project a picture 15 feet high. What focal length lens will be necessary?

Given:

Aperture height, 0.6″; picture height, 180″; projection distance, 1,200″.

$$M = \frac{\text{height of aperture}}{\text{height of picture}} = \frac{a}{b} \text{ or}$$

$$M = \frac{0.6}{180} = \frac{a}{1{,}200}$$

$$a = \frac{0.6 \times 1{,}200}{180} = 4$$

$$\frac{1}{f} = \frac{1}{a} + \frac{1}{b} \text{ or } \frac{1}{f} = \frac{1}{4}$$

$$+ \frac{1}{1{,}200} = \frac{1{,}200 + 4}{4{,}800} = \frac{1{,}204}{4{,}800}$$

$$f = \frac{4{,}800}{1{,}204} = 3.98'', \text{ answer}$$

Characteristics of RCA Photophone Tubes

With explanatory notes covering their use in all types of RCA equipment

Equipment	Amplifier	Radiotrons	Filament Voltage	Grid Voltage	Plate Voltage	Plate Current (ma.)	Remarks
PG-3, 4, 6, 7 & 8	PA-12A	UX-210	6	— 9	135	3	1. Voltage amplifier using 6 Radiotrons UX-210 connected in 3-stage push-pull circuit. Battery power.
	PK-1	UX-250 UX-281	7.5 7.5	—84	450 ...	55 75	2. Power amplifier using 2 Radiotrons UX-250 in single push-pull stage with 2 UX-281's to furnish plate and grid voltages from A. C. supply.
PG-10	PA-12B	UX-112A	5.	— 9	135	3.1	3. See remarks No. 1 above, except as to type of tube.
	PK-1	UX-250 UX-281	7.5 7.5	—84	450 ...	55 75	4. See remarks No. 2 above.
PG-13	PA-41	UX-112A UX-112A UX-112A UX-250	5 5 5 7.5	— 9 — 9 —13.5 —85	115 115 149 425	3.1 3.1 2.7 35	5. Voltage and power amplifier using 3 voltage amplifying stages with single UX-112A in each, followed by a power stage using 4 UX-250's in a push-pull parallel circuit; D. C. power from a 3-unit M. G. set.
PG-28	PA-67	UY-224* UY-227 UX-245	2.5 2.5 2.5	—1.4 —8 —46	155 140 245	2 4 30	6. Voltage and power amplifier of 3 stages using 2 UX-245's in push-pull in the power stage; completely AC-operated.
		UX-280	5	....	...	42–50	6a. –42 ma. in PA67A1; –50 ma. in PA67A3.
PG-30	PB-23	UY-224† UY-227 UX-245 UX-280	2.5 2.5 2.5 5	—0.6 —6 —44	180 100 220 ...	1 3.5 30 40	7. Voltage amplifier of 3 stages using 2 UX-245's in push-pull in the output stage; completely AC-operated.
	PB-24	UX-250 UX-281	7.5 7.5	—75	435 ...	45 67	8. Power amplifier using 2 UX-250's in push-pull; completely AC-operated.

*Notes: *Has a screen voltage of 62; † has a screen voltage of 30.*

[*This table prepared exclusively for* INTERNATIONAL PROJECTIONIST]

PRACTICAL PROBLEMS BASIS FOR ACADEMY PROGRAM

Lester Cowan

EXECUTIVE SECRETARY, ACADEMY OF M. P. ARTS AND SCIENCES

PRACTICAL studio problems and correlation between studio and theatre practices have formed the basis of the Academy technical program during the summer months. In addition to the projects delegated to sub-committees by the Producers-Technicians Committee a number of conferences of studio and theatre technicians have been held on problems which may be approached through a cooperative effort by the various units of the industry during the winter months.

A summary of the more important work of the individual committees and the Academy Technical Bureau since the last Bulletin includes a wide range of activities:

Standard Apertures

Specifications for standard camera and projector apertures in three by four proportions are now being worked out from data supplied by the studios, laboratories, and equipment manufacturers. Specifications are to be presented to the studios within the next week, for study and decision.

The proposal is a second step in the standardization of apertures begun by the Academy in 1929. It is made possible now by the decrease in the use of sound-on-disc and the increasing number of theatres restoring the 3 x 4 proportions from movietone pictures by a reduced proportional aperture and shorter focal-length lens.

Conferences of studios representatives have been held at which it was agreed that if other considerations in the industry will permit the establishment of a new standard, considerable savings can be effected in the studios. Estimates indicate that standardizing of apertures would save from a half-hour to an hour a day production time on every set now being spent in setting up cameras, lights and microphones to allow for the dead picture area on the film. Lights and microphones could be dropped from three to five feet lower, and as much as six feet can be cut off the top of large sets. Sets could also be reduced in width.

Specifications allowing the necessary tolerances for the various processes in photography, printing and projection are being worked out by a sub-committee consisting of Virgil Miller, Joe Dubray and George Mitchell. A conference of executives of nine studio sound departments has determined on sound track requirements. Other data is being secured from laboratories and manufacturers of projection equipment.

Standard Release Print

Results of the national survey of representative projectionists has been completed, strongly supporting the Standard. To date 650 questionnaires have been returned from 46 states and Canada including replies by 120 local union secretaries, so that the survey covers about a thousand theatres of all classes.

Meetings of the sub-committee and of groups of projectionists have been held and the survey questionnaires have been thoroughly studied. The committee also secured special engineering surveys by E.R.P.I. and RCA Photophone. From this data only a few minor changes have been shown to be desirable.

As projectionists should now be accustomed to finding the changeover signals, the sub-committee is planning to recommend a slight reduction in the size of the cues. Other minor revisions of the specifications are under consideration and will be announced in the near future.

S.M.P.E. Approves S.R.P.

The following resolution has been received from the Projection Practice Committee of the Society of Motion Picture Engineers. This committee is chairmaned by Harry Rubin, who has been active in the work of the Projection Advisory Council supporting the Standard.

WHEREAS, the Standard Release Print has been in widespread use during the past several months and has resulted in the reduction of film mutilation and the elimination of punch-marking of film for change-over purposes, AND

WHEREAS, the Standard Release Print has contributed to improved change-overs and smoother performances;

THEREFORE, be it resolved that the Projection Practice Committee go on record as endorsing the said Standard Release Print as a practical step in the improvement of projection.

Film Processing

The Film Processing Committee chairmaned by M. C. Levee is working toward determination of desirable standards in processing and quality.

Replies have been received from nearly all the studios to an exhaustive questionnaire covering all phases of film processing methods and standards. These replies have been tabulated and studied by a sub-committee consisting of W. C. Harcus, Wesley C. Miller and C. Roy Hunter. A comparison of the gamma and density scales in use at different laboratories is now being carried out for the sub-committee by Dr. John C. Frayne of Electrical Research Products, Inc.

Camera Silencing

The Producers-Technicians Committee several months ago authorized that measures be taken to stimulate camera manufacturers toward developments to make the present clumsy and expensive camera blimps unnecessary. Cameramen are uniformly opposed to blimps and blame them for slowing their work. A sufficiently silent camera would make possible great savings in time on the set.

A series of surveys, manufacturers conferences and sub-committee meetings have been conducted on this project. Through these the main difficulties in the way of a silent camera have been brought out and information supplied the manufacturers as to requirements common to all studios.

REASONABLE CARE PROLONGS LIFE OF VACUUM TUBE

THE life of a vacuum tube is greatly reduced if the filament current is too high. The reason for this is that an overheated filament throws off electrons at an excessive rate, and the oxide coating, which supplies most of the electrons, therefore becomes rapidly exhausted.

When a filament is near the end of its life, a weak spot usually develops which glows more brightly than the remainder. Whenever a tube begins to show this symptom it should be replaced by a new tube from the spare stock. If the filament current is too low the tube will not be harmed, but the system will not deliver proper volume and the quality may be impaired, therefore, always carefully regulate the filament current to the value specified by the maker.

In some amplifiers, two or more vacuum tubes are operated with their filaments in series; if one of the tube filaments burns out the others will also be extinguished. It is advisable for every projectionist to study the schematic of each amplifier, so that he will be familiar with every possible condition when trouble is encountered.

"KELDUR" DISTRIBUTION

"Keldur," anti-vibration material which is finding wide application in the motion picture industry, is now being distributed in the East by Steinmetz & Co., with offices in New York and Philadelphia. The New York office, at 30 Church Street, is under the direction of R. G. Hess.

LOCAL ADVERTISING SHOULD FEATURE THE CRAFTSMAN—NOT THE LABOR UNIONIST

James J. Finn

THE idea of advertising the trade unionist is decidedly not new. Labor has many times come off second best in its encounters with capital, represented by the large corporations in America and elsewhere, and that intangible something known as "public opinion," molded by capital through the medium of publicity into falling in with its way of thinking, usually figured largely in determining the final result.

Capital early learned the monetary value of intelligent publicity, particularly in its encounters with labor; but labor, simulating that "old dog," was slow to learn new tricks. This undoubtedly was due to the resistance of the labor leaders, most of whom were (and still are), of the so-called "old school." And even when it did take its cue from capital and adopt modern methods of shaping public opinion, labor quickly demonstrated its ineptness for the tools with which it was working.

A classic case in point is that of the cigarmakers' union—the best advertised labor organization in the world. A few years ago one could not travel any appreciable distance—afoot, by automobile, or by train—without being confronted with an advertisement of the cigarmakers' union. Great stuff, this advertising. Great. . . . What is the status of the cigarmakers' union today? Some say that machines accomplished the rout of the cigarmakers; and undoubtedly they had a lot to do with the disintegration of this organization. But even so, the percentage of union made cigars in relation to the total amount sold today is so small as to be almost negligible. The answer is not difficult to find. But more of this later.

Little Improvement Today

Today sees little improvement in labor's approach to this problem. True, there is a plentitude of labor union advertising—in labor papers, pamphlets, handbills, house organs, by pickets, and, lately, by radio. But withal, labor still is ignorant of how to properly go about the job.

So much for labor union advertising in general.

Of particular interest here is the rapid spread of localized advertising among units of the International Alliance. Here is a group of unions which doesn't have to be "sold" on the idea of advertising themselves. Why, they literally fell in love with the idea. Now a large number of local unions are advertising; and the promoters of various enterprises all are enjoying a crack at the local union treasuries—the printers, the artists, the paper houses, the button manufacturers, the banner makers, and the radio, particularly the latter.

Overlook 'Selling Point'

Advertising is fine. Everybody knows the writer is a firm believer in advertising, and the more the merrier. But, seriously, it occurred to the writer as one who is merely an observer on the sidelines that now is the time to pause and give some thought to the *character* of this labor union advertising. *What kind* of advertising is it . . . and does it get results? We doubt it.

Of all the advertising by International Alliance local unions that we have seen, only one or two specimens may be said to have reflected any understanding of the primary purpose of advertising—to create a demand for something, to sell something. Advertising a labor organization is an attempt to create a demand for a commodity just as definitely as is the advertising of any mercantile organization. But these latter merchants display common ordinary horsesense in that they advertise their product; while labor unions make the fatal mistake of advertising not their product but their organization, with particular stress on the fact that it is a *labor* organization.

Those to whom all this labor union advertising is directed are not interested in labor organizations—they don't want to

Food for Thought—

The average experience of the members of our union is 15 years 5 months.

UNION operators have experience.

Skill and Care Insure Safety

The base of motion picture film is gun cotton. It is not explosive but it is highly inflammable. Care is required to prevent the heat generated by a light of many thousand candle-power from igniting it. Union operators are careful. WHEN PURCHASING THEATRE TICKETS BE SURE THAT YOU RECEIVE THIS EXTRA PROTECTION TO WHICH YOUR MONEY ENTITLES YOU. ASK TO SEE THE UNION EMBLEM AT THE BOX OFFICE.

UNION SEAL

SILENTLY, SAFELY WE SERVE YOU

MOVING PICTURE OPERATORS UNION NO. 250

Affiliated with the American Federation of Labor

An example of intelligent newspaper advertising by Salt Lake City L. U. No. 250

buy the organization. But they are interested in *what* the labor organization has to offer, to sell them: better quality work not primarily because of the organization but because of the better craftsman who is a member of that organization. Sell the craftsman, not the organization.

This is what is the matter with labor union advertising; this is what our friends the cigarmakers overlooked; and this is what countless other labor unions are doing today to waste the money of their members: they concentrate their attention upon selling union labor, in which practically nobody is interested, and neglect almost wholly to stress the one point that *is a selling point*, and that the quality work produced by its member craftsman.

In the motion picture business, in which we are particularly interested, the public is buying entertainment. Naturally it is important whether the great theatregoing public can be entertained in pleasant surroundings and without being annoyed by distractions as a result of inferior work, and without having to think about the consequences of inadequate safety measures.

International Alliance local unions have just two things to sell this vast army of theatregoers: (1) better work by a craftsman who knows his job, and (2) absolute safety which is guaranteed by this same craftsman who through proper training and long experience may be counted upon to so do his work that no safety factor is slighted. The local union merely as a labor organization cannot give assurance on either of these points; but the craftsman member of the organization, by virtue of his standing as a craftsman, is assurance that his work—in this case, projection work—will be done competently and with a maximum of safety. The organization can merely brag about its better craftsmen.

But do they? Not at all. The linotypes click, the presses roll, words pour forth from loudspeakers and banners scream their messages from points of vantage—and serve only to inform the public that a labor organization demands work merely because it is a labor organization.

Complete data relating to the organization is given: when it was organized; how many illustrious leaders it has had; how many of its members fought in the World War; how much money its members spend in the town; the present president's name (usually in large red letters occupying about half the available space) —but not a word relating to *why* its members are better craftsmen.

Let there be a complete about-face on this matter of advertising the labor uuion. Let the craftsman have all the glory; after all, he *is* the organization. Tell the story of *why* the organization member is a superior worker, and let the organization enter into the matter only for the reason that it *insists* that its members be proficient. The job can be done right. Accompanying this article is just one sample of intelligent advertising in this direction. Many more could be shown, but this one specimen will convey the general idea.

Forget the organization. Sell the craftsman.

Recent Technical Books

Recording Sound for Motion Pictures, *edited by Lester Cowan for the Academy of Motion Picture Arts and Sciences. A compilation of* 24 *papers by as many writers.* 24 *chapters,* 419 *pages, including glossary and index. Profusely illustrated. Published by McGraw-Hill Book Co., New York. Price* \$5.00. 9¼ *x* 6.

The story of sound motion pictures from the technical standpoint is contained in this book, a compilation, under the editorship of Lester Cowan, of twenty-four papers written by technicians who played an active rôle in the development of the technique of sound recording and reproduction. Some of the papers included herein were previously released in the Technical Digest of the Academy of Motion Picture Arts and Sciences and were printed in the various trade and technical publications.

"The Ancestry of Sound Pictures," by H. G. Knox, and "The Nature of Sound," by A. W. Nye serve as introductory chapters to the following main divisions; "Sound Recording Equipment," "The Film Record," "Studio Acoustics and Technique," and "Sound Reproduction." Following these divisions is a glossary of technical terms and a very useful index.

There can be no question that this volume is authoritative, as each writer is an acknowledged expert in his particular work. These gentlemen knew their theory before they attempted the sound picture job; and in doing the job they quickly reconciled theory with practice. Their experiences are set down in this volume. Nothing more need be said by way of recommendation. This is the one book which reflects a proper approach and a finished execution in the compilation of technical data relating to the sound picture. Every serious worker in the art, as well as those who are interested in any way in sound pictures, should have a copy of this book. Recommended unreservedly.

Television, Its Methods and Uses, *by Edgar H. Felix.* 272 *pages, illustrated, with index. Published by McGraw-Hill Book Co., New York. Price* \$2.50. 5½ *x* 8.

This is the first really practical book on television that has come to our notice. The "low-down" on the art is given herein, and in such a manner as to provide a refreshing contrast to the conventional expositions of the subject. Mr. Felix has the happy faculty of making a complex subject appear relatively simple, a characteristic which marks all his technical writings. This, his latest book, is written in a style that smacks of fiction and maintains the reader interest from start to finish. The novice as well as the trained television worker will find this volume valuable.

We think it fortunate for the television art that Mr. Felix has written this book. Cutting through the mass of over-enthusiastic publicity releases, he has pierced the core of the subject and given an accurate picture of the status of the art today. He tells in a remarkably straightforward manner the shortcomings of the art, which are many, and displays neither fear nor favor in enumerating the various factors which have militated against this baby science. Mr. Felix feels that "a conservative attitude is particularly helpful at this time, because television has been treated to an excess of premature and unwarrantedly hopeful publicity."

He who would know the "how" and "why" of television should have this book.

Projecting Sound Pictures, *by Aaron Nadell.* 265 *pages,* 100 *illustrations, with index and chapter questions and answers. Published by McGraw-Hill Book Co., New York. Price* \$2.50. 6 *x* 9.

It is to be regretted that Mr. Nadell did not write this book shortly after the "first flush" of sound motion pictures, when projectionists were eagerly searching for such data, for if he had, his work today would be the standard by which all similar efforts would be judged. As it is, much of the force of the book is lost for the reason that the same ground has been worked over not once but many times by other writers who, while probably not possessing the ability Mr. Nadell does, have done reasonably well in their efforts. This Nadell book is good—very good—but it is questionable whether in the light of the foregoing statement, it will exert any particular appeal among projectionists.

Mr. Nadell concerns himself largely with theory, yet in such a manner that the "meat" of his story emerges vividly clear-cut. This does not imply that this work has neglected the practical side of the question, for Mr. Nadell proceeds from theory to practice with considerable ease, and combines both elements in an understandable whole. Long experience in the reproduction field, in addition to an apprenticeship with Electrical Research Products, have eminently qualified Mr. Nadell for his task, and the knowledge thus gained is reflected in this work.

James J. Finn.

S. M. P. E. FALL MEETING AT SWAMPSCOTT, MASS., OCTOBER 5 TO 8

Meeting to mark 15th anniversary of Society. Engineering pioneers to be honored. Crabtree to retire as President. Papers program reveals little of particular interest to the projectionist.

THE annual Fall meeting of the Society of Motion Picture Engineers will be held at Swampscott, Mass., October 5 to 8, inclusive. The New Ocean House will be the headquarters for the Convention. The Papers Committee has announced a program of more than fifty papers for this meeting, attendance at which is expected to be swelled by many who could not attend the last meeting on the West Coast.

The Swampscott meeting will mark the retirement of J. L. Crabtree as President of the Society. Dr. A. N. Goldsmith, Vice-President and Chief Engineer of the Radio Corporation of America, and Dr. V. B. Sease, Director of Research, Du Pont-Pathe Film Manufacturing Co., have accepted their nominations for President. E. I. Sponable, Director of Research and Development, Fox Film Corporation, and M. W. Palmer, Electrical Engineer, Paramount-Publix Corporation, are the nominees for Vice-President.

Nominations for Offices

Other nominees are as follows: J. H. Kurlander, Commercial Engineer, Westinghouse Lamp Co., and R. E. Farnham, Commercial Engineer, General Electric Company, for Secretary; H. T. Cowling, Eastman Kodak Company, and W. B. Little, Engineer in Charge of Photometry- Electrical Testing Laboratories, for Treasurer; L. C. Porter, Illuminating Engineer, General Electric Company; W. H. Carson, Vice-President, Agfa-Corporation; W. B. Rayton, Director of Scientific Bureau, Bausch and Lomb Optical Company; and O. M. Glunt, Assistant Director of Apparatus Development, Bell Telephone Laboratories, for members of the Board of Governors.

These nominations has occasioned no little surprise among that element of the Society membership which long has held that the Society was fast losing its original character as a *motion picture* organization through the medium of selecting officers and members of the governing body who are not strictly motion picture workers and in permitting a large portion of its papers programs and interest to be devoted to subjects not of general appeal to the motion picture field.

Society's 15th Anniversary

This meeting of the Society will hold unusual interest because it will mark the Society's 15th birthday. In addition to the customary scientific program, the four-day convention will give recognition to the anniversary. The Society banquet on Wednesday evening, October 7, will honor the engineering pioneers of the industry. Certificates of honorary membership will be presented to Thomas Alva Edison, Frederic Eugene Ives, Louis Lumiere, Charles Francis Jenkins, and George Eastman. Invitations to the banquet have been issued to Eugene Lauste, Jean A. Le Roy, Thomas Armat, Donald Bell, George Melies (France); Oscar Messter and Max Sladanowsky (German); Robert Paul and W. K. L. Dickson (England); Charles Friese-Greene, son of William Friese-Greene; Miss Marie Le Prince, daughter of L. A. A. Le Prince; Edwin Porter, and D. W. Griffith.

The papers program, while listing few papers of direct interest to projectionists and to those interested chiefly in reproduction in the theatre, discloses the following papers which may prove of general interest: "Mechanical Advantages of the Optical Intermittent Projector," by J. L. Spence, Akeley Camera, Inc., New York; "Report of the Standards Committee," by A. C. Hardy, Chairman; "Report of the Color Committee," by W. V. D. Kelly, Chairman; "Proposed Changes in the Present Standard 35 mm. Film Perforation," by A. S. Howell and J. A. Dubray, Bell & Howell Co., Chicago.

Also: "Motion Pictures in Relief," by H. E. Ives, Bell Telephone Laboratories; "Report of the Sound Committee," by H. B. Santee, Chairman; the reports by the various projection committees—Practice, Theory, and Screens—by H. Rubin, W. B. Rayton, and S. K. Wolf, respective chairmen; "The Screen—A Projectionist's Problem," by F. M. Falge; and "Low Amperage Reflecting Arc Lamp for Portable Sound Equipment," by H. H. Strong, Strong Electric Co., Toledo.

What is expected to be one of the most important motion picture engineering papers to be delivered in recent years will be read by Dr. Herbert E. Ives. The title of Dr. Ives' paper will be "The Problems of Projecting Motion Pictures in Relief" and it is perhaps the first thoroughgoing effort, from a scientific standpoint, to outline the scientific principles involved in the projection of motion pictures in relief to obtain the effect of third dimension. Due to the tremendous amount of work and money that has been spent in recent years to produce the third-dimension effect in motion pictures, it is expected that Dr. Ives' paper will be of unusual interest to the industry as a whole.

Dr. Ives is director of electro-optical research at Bell Telephone Laboratories and is responsible for the coordination in television research and much of the television research has been done under his direction.

Abstracts of Papers

The following abstracts of papers to be read at the meeting were available at the time of going to press:

STUDIO PROJECTION AND REPRODUCTION PRACTICE, *by John O. Aalberg, RKO Studios, Inc., Hollywood.*

The number of projection rooms in Hollywood studios varies between 1 and 15, depending on the production capacity of the studio. Projection distances average about 60 feet. In general, reproducing equipment is furnished by the company whose recording apparatus is used. During shooting and editing of a picture, the sound track and picture are on separate films, practically doubling the amount of equipment needed and calling for special synchronizing devices.

Daily and weekly routine checks covering frequency characteristics, power levels and screen brightness are described, as well as small projectors and reproducers used for inspecting release prints in film processing laboratories. The paper also covers special applications, such as reproducers on stages (play-backs), used for furnishing music or for special work, as in split-mat photography, special uses in scoring, trick work, etc.

VERTICAL SOUND RECORDS — Recent Fundamental Advances in Mechanical Records on "Wax," *by H. A. Frederick, Bell Telephone Laboratories.*

This paper describes recent progress which has been made in laboratory studies of mechanical records of sound cut on a wax disc. Both theoretical and experimental investigations indicate that a phonograph record cut with vertical

undulations instead of the more usual lateral undulations possesses fundamental advantages. The principal improvement comes from a marked increase in the volume and frequency range over which faithful reproduction may be obtained. A higher volume level can be recorded for the same groove spacing and speed. More playing time can be provided with a given size record and volume level since, for these conditions, both the groove spacing and speed may be reduced. Improvements in methods of processing the stampers and in the record material give a large reduction in surface noise and hence a corresponding increase in the volume range. With these improvements the frequency range which can be satisfactorily reproduced can be extended nearly an octave to 8,000 to 10,000 cycles. Other improvements incidental to the improvements noted above are, great improvement in the quality of reproduction obtainable directly from a soft "wax" record and a great extension in the life of the hard record.

The Problem of Projecting Motion Pictures in Relief, *by Herbert E. Ives, Bell Telephone Laboratories.*

The essential conditions for producing pictures in stereoscopic relief are two: First, separate pictures must be made from different points of view, corresponding to the two eyes; second, each eye of the observer must receive its appropriate view. No compromise with these fundamental requirements appears possible.

If steroscopic projection is to be achieved in such a form that a large group of observers may simultaneously see the projected picture in relief, the distribution of the appropriate views to the two eyes must be accomplished for each observer. There are just two places where the distribution may be made: the first is at the observers' eyes; the second is at the screen on which the picture is projected.

If the first method is employed, two separate images must be provided on the screen, and every observer must have means for directing one image to the right eye and one to the left eye. Such means comprise special spectacles equipped with deflecting mirrors or prisms, spectacles equipped with polarizing prisms, spectacles equipped with glasses of complementary colors, or spectacles carrying sector discs operated by synchronous motors. In each case the two images upon the screen must be differentiated in the correspondingly appropriate manner, that is, they must be projected side by side, they must be projected with light polarized in two planes, with colored lights, ar alternately. These schemes have the objection that a large number of observing units must be provided, which are more or less inconvenient for the users.

If distribution of the image is to be made at the screen, two images are no longer sufficient. Theoretically an extremely large number must be provided, a separate one for each position that can be occupied by any eye in the audience, so that wherever an observer may station himself each eye will see a separate image, properly differentiated in character from that received by the other eye. Still pictures exhibiting relief from whatever direction viewed (parallax panor magrams) have been produced having the property of showing relief from all angles and distances of observation. These are made by photographing an object from a large number of points of view through an opaque line grating, or ridged screen, and viewing the resultant picture through a similar grating. Some development of the parallax panoramagram method is indicated as the theoretical solution of the problem of projection in relief.

Several methods of utilizing the parallax panoramagram method are discussed. It appears that from the theoretical standpoint the problem of relief projection is entirely solvable, and experimental tests of still picture projection have been successfully made. Practically the solution of relief projection of motion pictures will depend upon the use of apparatus involving excessive speeds of operation, great multiplicity of taking or projecting units, projection screens containing minute ridged reflecting or refracting elements of extreme optical perfection, projection lenses of extraordinary defining power, microscopic accuracy of film positioning and photographic emulsions of speeds at present unknown.

Utilization of Desirable Seating Areas in Relation to the Screen Shapes and Sizes and Theatre—Floor Inclinations, *by Ben Schlanger.*

The aim of this paper is to establish a relationship between the bodily posture of the patron, the size and shape of the picture, and the architectural form of the theatre in all its details. The present type of theatre floor is compared with the reversed type described in a previous paper in order to show how the latter type of floor enables a greater number of seats to be placed within the desirable seating areas.

An anlaysis is also made of the effect of the reverse floor as contributing to comfortable bodily posture. Definite angles of sight specified by the various tilts of chair backs found necessary for good posture are shown. Several forms of theatres of various seating capacities and screen sizes are described in order to show the broad application of the theories involved in reversing the pitch of the orchestra floor.

Western Electric Noiseless Recording, *by H. C. Silent, Electrical Research Products.*

The Western Electric method of noiseless recording with the light valve is described. The general principles are discussed, the circuit diagram is explained, and the method of adjusting the device for service described. The photographic characteristics of film are considered and their application in noiseless recording is shown in some detail.

P. A. C. JOTTINGS

Regional representatives on technical activities appointed by James J. Finn

PREPARATIONS for an active Fall and Winter season by the Projection Advisory Council are now being made. Announcement of the appointment of regional representatives on Council technical activities has been made by James J. Finn, Chairman of the Ways and Means Committee, and is appended hereto. These appointments, made with the approval of President Thad Barrows and Executive Vice-President P. A. McGuire, will enable the Council to coordinate its activities throughout this country and in Canada and will make for direct contact with projectionists in the respective territories. The roster is not yet complete, several appointments still remaining to be made.

A call for a meeting of officers and directors of the Council to be held in New York on October 16 has been issued by P. A. McGuire. At this meeting plans for the coming season will be outlined, with special attention due to be given the matter of increasing the membership of the Council.

The Council still is awaiting action by the Technical Bureau of the Academy of Motion Pictures Arts and Sciences regarding suggested changes in the Standard Release Print, the specifications of which received the approval of the Technical Coordination Committee of the Council several months ago. These changes are in the main concerned with the number, position and size of the visual cue signals which appear on the S. R. P. The questionnaire circulated by the Academy through the Council disclosed general approval of the S. R. P., although many projectionists registered their preference for smaller and fewer dots. Very few requests favoring changing the dots from the upper to the lower corner of the frame were received.

As soon as a report on these changes is received from the Academy, the Council will make every effort to see that the S. R. P. is enforced in the field. The regional representatives will play an active part in this campaign. For its part, the Academy will work through the Motion Picture Producers and Distributors of America (Hays organization), in seeing that exchanges observe the provisions of the standard, in addition, of course, to overseeing studio practice.

It appears unlikely that any action will be taken on the suggestion that a penalty for non-observance of S. R. P.

QUESTIONS & ANSWERS

A department which will be a regular monthly feature and to which all projectionists are invited to contribute.

QUESTION and answer departments are valuable only to the extent to which readers cooperate in making them so. An active reader interest in this department will benefit not only the individual but the craft at large. Questions will be answered in the order in which they are received. All questions will be numbered. Neither names nor initials will be appended to the questions; but any comment relating to the answers will include the writer's name. Send in your questions now.—*Editor.*

1. *What effect will the placing of the projection room above the center of the screen have on the shape of the picture?*

Ans.—This will result in what is commonly known as a "keystone effect."

2. *Is it advisable to plass glass in observation ports, and if so, why?*

Ans.—Yes, because glass ports will prevent the emanation of sound from the projection room into the auditorium. These glass ports should be opened for inspection of the screen by the projectionist.

3. *Would you use water on a film fire?*

Ans.—No. Water will not extinguish a film fire.

4. *Why should both ends of the rewinders be in line with each other?*

Ans.—To prevent damage to the film, particularly to the sprocket holes.

5. *What will cause film to stop or pile up at the aperture opening or in front of the light beam?*

Ans.—(a) Intermittent sprocket not turning; (b) a break in the fim after it passes the top sprocket; (c) take-up not functioning properly.

6. *What will unequal gate springs or traps do to the film?*

Ans.—It will cause uneven tension.

7. *If sprocket idler rollers are out of line or binding, what may happen to the film?*

Ans.—The film may run off the sprocket and result in serious damage to the film.

8. *Why are new prints waxed, while old film is not?*

Ans.—On new film the emulsion is likely to adhere to the traps. On old film the emulsion is fairly well hardened. However, processing is preferable to waxing.

9. *Name some causes for "rain effect" on a motion picture screen.*

Ans.—The chief cause of "rain effect" is the accumulation of dirt in scratch grooves of the emulsion. When the film is rewound, this dirt is ground into the film and results in the "rain effect" when the film is next projected. This damage usually is done in rewinding.

10. *What is the cause of flicker?*

Ans.—A slow - running projector. However, when the standard sound picture speed of 90 feet a minute is adhered to, there should be no difficulty with flicker.

11. *What causes white streaks both up and down from letters or titles?*

Ans.—The shutter cut-off blade is too narrow.

12. *What will cause film to have an up-and-down movement on the screen?*

Ans.—(a) A defective intermittent; (b) improper (loose), tension.

13. *How would you correct "travel ghost."*

Ans.—By properly timing the shutter.

14. *Why is a revolving shutter used on a projector?*

Ans.—To cut-off the light while the film is in motion.

15. *Give some causes of condenser breakage.*

Ans.—(a) The condensor is too close to the light source; (b) improper ventilation; (c) the holder is too tight and does not permit the usual expansion and contraction of a condenser.

16. *How can the "size" of a wire be measured?*

Ans.—With a wire gauge.

17. *Can a cracked mirror be used?*

Ans.—Yes, but with inferior results.

18. *Why do high intensity arcs have the positive carbon revolve?*

Ans.—To keep a round crater and thus insure even burning.

19. *What is the best to use on A.C.—an economizer or rheostat, and why?*

Ans.—An economizer, because it is more economical.

20. *For what is a rheostat used?*

Ans.—To reduce the voltage to the desired arc voltage and/or to give the desired amperage.

Send in your questions

P. A. C. Jottings

specifications be invoked, both the Council and the Academy concurring in the opinion that cooperative action between all agencies concerned will net better results.

The regional representatives on technical activities, as announced by Mr. Finn, follow:

BOSTON, MASS. James L. Caddigan, 355 Chapman St., Canton, Mass.

NEW YORK, N. Y. Charles F. Eichhorn, Local Union 306, 125 West 45th St., New York.

LOS ANGELES, CALIF. H. E. Alford, 2828 West Boulevard, Los Angeles.

OAKLAND, CALIF. George Lancaster, Olympic Hotel, Oakland.

MILWAUKEE, WISC. Frank M. DeLorenzo, 4221 Oakland Ave., Milwaukee.

NEW ORLEANS, LA. E. L. Beaud, Local Union 293, P. O. Box 293, New Orleans.

SALT LAKE CITY, UTAH. George A. Yager, 167 N. W. Temple St., Salt Lake City.

MONTREAL, QUE., CANADA. H. Delorme, 366 Mayor St., Office 22, Montreal.

PORTLAND, OREGON. James L. Forsyth, 501 Labor Temple, Portland.

SAN FRANCISCO, CALIF. W. G. Woods, 230 Jones St., San Francisco.

TORONTO, ONT., CANADA. H. N. Elliott, 27 Sherwood Ave., Toronto.

ALBANY, N. Y. Claude Watkins, care of Strand Theatre, Albany.

OKLAHOMA CITY, OKLA. Berlin Parks, P. O. Box 380, Oklahoma City.

MINNEAPOLIS, MINN. Chauncey L. Greene, 2722 Harriet Ave., Minneapolis.

WASHINGTON, D. C. Emil Holz, 903 Delafield Place, Washington.

DETROIT, MICH. Ira Waddell, 640 Parkview Ave., Detroit.

ST. LOUIS, MISSOURI. O. Kleintopf, 237 Missouri Building, St. Louis.

BUFFALO, N. Y. Alec E. Cohen, Local Union 233, 408 Pearl St., Buffalo.

CLEVELAND, OHIO. Victor Welman, 207 Finance Building, Cleveland.

CHICAGO, ILL. P. L. Akins, 919 Cornelia Ave., Chicago.

VANCOUVER, B. C., CANADA. John C. Richards, P. O. Box 345, Vancouver.

PITTSBURGH, PA. Alfred L. Criswell, 3994 Beechwood Blvd., Pittsburgh.

CHARLESTON, S. C. J. H. Keener, P. O. Box 671, Charleston.

MOTOR GENERATOR REPAIRS

The maintenance of electrical machinery covers little points of systematic care which if followed keep the pulleys turning without much trouble.

1. Systematic oiling.
2. Systematic cleaning.
3. Care of d. c. commutators.
4. Care of d. c. brushes.
5. Care of d. c. starting device.
6. Care of a. c. rings.
7. Care of a. c. commutator rings.
8. Care of a. c. starting device.
9. Care of proper size of fuse.
10. General checking of schedule.

The EDITORIAL PAGE

Vol. 1, No. 1 OCTOBER 1931

Wanted: A Projectionist Organization

Formerly, projection was never given a thought other than with respect to how much it cost on the whole; but things are different today. This new interest in projection is reflected in the bidding by executives and organizations for the favor of the projectionist—they pay him pretty compliments, they make speeches about the importance of projection, and they stick an organization membership blank in his hand and "invite" him to affiliate. And, sad to relate, some projectionists react to such advances like a cat reacts to gentle stroking.

We don't want to engender any animosity by these remarks, but we must say that projectionists give us a headache these days by their insistence upon intruding where they are not really wanted, "invitations" nowithstanding. It is all very well to say (in a speech), that we are all "one big happy family, so let's all work together." This is great stuff—in a speech. But it hardly ever works out well in practice, particularly where, as is the case with respect to the relation of projection to the rest of the industry, in the very nature of things the interests of one faction do not coincide with those of another. There would not, could not, be any reason for complaint if projectionists would first favor their own organizations, and then affiliate with another in addition. But projectionists "pass up" their own organizations and clamor for admittance to organizations in which they do not belong and are not wanted. These latter organizations may admit projectionists, but in so doing they never accept them: they merely tolerate them and offensively patronize them.

Where is the man who can establish, or build upon an existing nucleus, an organization that will promote the interests of the projectionist all along the line? The situation demands either a Moses or a Washington, or maybe a combination of both. Such a man would supply the answer to a problem that is becoming increasingly important as the days flit by. Such a man would change the status of the projectionist from that of an humble supplicant for favors to that of a respected craftsman who could speak with an authoritative voice and command proper attention for his work and for his craft.

The Question of Proper Power Supply

Sponsorship of all A.C.-operated sound reproducing systems by reputable engineering companies has given impetus to the demand for this type of equipment and has revived interest in the old question as to what constitutes the most satisfactory source of power supply. Some two years ago a hue and cry was raised against the use of storage batteries, and we were in the vanguard of that group which shouted lustily that batteries must go. As a matter of fact, we have the now somewhat doubtful honor of having been the first to suggest that storage batteries be replaced by (1) motor generator sets; (2) rectifiers, and/or (3) the substitution of a coarse exciter lamp filament for the conventional thin filament. These suggestions were couched in very positive terms: our statements admitted of no contrary opinion. Oh, well. . .

The question is: Do storage batteries provide the most satisfactory source of power for sound reproducing systems, and if so, why? One group supports the opinion that there is no kind of generated or induced current that will give a straight line voltage curve; batteries, this group holds, supply a constant, even flow of current far beyond the "danger line" for sound reproduction. Another group holds that several substitutes may be utilized which are "just as good" and, furthermore, less expensive and not one-half the "nuisance" that batteries are. If any unit of equipment can be replaced by something "just as good" which is less expensive, by all means make the replacement. But first we should establish definitely the facts which prompt the statement "just as good." As for storage batteries being a "nuisance" it should be pointed out that any substitute equipment will certainly require some measure of attention—possibly as much or more than is now given to batteries. Regarding the matter of expense, time alone will provide the answer.

Statements of "just as good" usually are backed with little performance data. One's ears may easily deceive one in any comparative test of sound quality, and even the trained ear is liable to error in judging any such test. What is needed in this particular case is fact, not fancy; performance figures should tell the story. Modern science has provided the means for obtaining the answer to this problem; and we will gladly cooperate to the best of our abilty to supply this answer.

Why Not Remote Volume Control?

The problem of proper volume control still provokes much thought and comment among sound motion picture technicians. The Practical Projection Committee reported to the Hollywood Convention of the S.M.P.E. that "the proper and best place for observance of volume is in the auditorium among the audience." The same report also stated that "there are now devices on the market which permit remote control. Whether the use of these devices has proven effective is not clear, but the fact remains that there is a general urge from the industry to investigate fully the whole problem of volume control." And there the matter rests.

Projectionist opposition to remote volume control is quite silly, in addition to being futile. Volume control is not now and never has been properly the concern of the projectionist. Simply because the first sound picture equipments provided for volume control by the projectionist from a fader on the projection room wall, with the monitor horn as an adjunct, is no reason why this unsatisfactory arrangement should be continued. Volume control from the projection room has failed completely to fill the bill. A satisfactory remote volume control *is* available. Why not use it? We are certain that all progressive projectionists will welcome such equipment.

NEW SCREEN IMAGE TABLE

SOUND-ON-FILM

E. F. in.	40 ft.	50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	120 ft.	130 ft.	140 ft.	150 ft.	160 ft.	170 ft.	180 ft.	190 ft.	200 ft.
2.00″	15.8 11.9	19.9 14.9	23.9 17.9	27.9 20.9	31.9 23.9	35.9 26.9	39.9 29.9	43.9 32.9									
2.25″	14.1 10.6	17.7 13.3	21.3 15.9	24.8 18.6	28.3 21.2	31.9 23.9	35.5 26.6	39.0 29.2	42.6 31.9	46.1 34.6							
2.50″	12.6 9.5	15.9 11.9	19.1 14.3	22.3 16.7	25.5 19.1	28.7 21.5	31.9 23.9	35.1 26.3	38.3 28.7	41.5 31.1	44.7 33.5						
2.75″	11.6 8.7	14.5 10.9	17.4 13.1	20.3 15.2	23.2 17.4	26.1 19.6	29.0 21.8	31.9 23.9	34.9 26.1	37.8 28.3	40.7 30.5	43.6 32.7	46.6 34.9				
3.00″	10.6 7.9	13.2 9.9	15.9 11.8	18.6 13.8	21.3 15.9	23.9 17.9	26.6 20.0	29.3 22.0	31.9 23.9	34.6 25.9	37.2 27.9	39.9 29.9	42.6 31.9	45.3 34.0			
3.25″	9.8 7.3	12.3 9.2	14.7 11.0	17.1 12.8	19.6 14.7	22.1 16.0	24.5 18.4	27.0 20.3	29.5 22.1	31.9 23.9	34.4 25.8	36.8 27.6	39.3 29.5	41.7 31.3	44.2 33.1		
3.50″	9.1 6.8	11.4 8.6	13.7 10.3	15.9 11.9	18.2 13.7	20.5 15.4	22.8 17.1	25.1 18.8	27.4 20.5	29.6 22.2	31.8 23.9	34.1 25.5	36.4 27.3	38.7 29.0	41.0 30.8	43.3 32.5	45.6 34.2
3.75″		10.6 7.9	12.7 9.5	14.8 11.1	17.0 12.8	19.1 14.4	21.3 16.0	23.4 17.6	25.5 19.1	27.7 20.7	29.8 22.3	31.9 23.9	34.1 25.6	36.2 27.2	38.3 28.8	40.4 30.3	42.6 31.9
4.00″		9.9 7.4	11.9 8.9	13.9 10.4	15.9 11.9	17.9 13.4	19.9 14.9	21.9 16.4	23.9 17.9	25.9 19.4	27.9 20.9	29.9 22.4	31.9 23.9	33.9 25.4	35.9 26.9	37.9 28.4	39.9 29.9
4.25″		9.4 7.1	11.3 8.5	13.2 9.9	15.0 11.3	16.8 12.6	18.7 14.0	20.6 15.4	22.5 16.8	24.4 18.3	26.3 19.7	28.2 21.1	30.0 22.5	31.9 23.9	33.8 25.3	35.7 26.8	37.6 28.2
4.50″			10.7 8.0	12.4 9.3	14.2 10.6	16.0 12.0	17.7 13.3	19.5 14.6	21.3 15.9	23.0 17.2	24.8 18.6	26.6 19.9	28.3 21.2	30.1 22.6	31.9 23.9	33.7 25.3	35.5 26.6
4.75″			10.1 7.6	11.8 8.9	13.5 10.1	15.2 11.4	16.8 12.6	18.4 13.8	20.1 15.1	21.8 16.4	23.5 17.6	25.2 18.9	26.8 20.1	28.5 21.4	30.2 22.6	31.9 23.9	33.6 25.2
5.00″				11.2 8.4	12.8 9.6	14.4 10.8	16.0 12.0	17.6 13.2	19.2 14.4	20.8 15.6	22.3 16.8	23.9 17.9	25.5 19.1	27.1 20.3	28.7 21.5	30.4 22.8	32.0 24.0
5.25″				10.6 7.9	12.1 9.1	13.7 10.3	15.2 11.4	16.7 12.5	18.2 13.7	19.7 14.8	21.2 15.9	22.8 17.1	24.3 18.3	25.9 19.4	27.4 20.5	28.9 21.7	30.4 22.8
5.50″				10.2 7.6	11.6 8.9	13.0 9.8	14.5 10.9	15.9 11.9	17.4 13.0	18.8 14.1	20.3 15.2	21.7 16.3	23.2 17.4	24.6 18.5	26.1 19.6	27.5 20.6	29.0 21.7
5.75″					11.0 8.3	12.4 9.3	13.8 10.3	15.2 11.4	16.6 12.4	18.0 13.5	19.4 14.5	20.8 15.6	22.2 16.6	23.6 17.7	25.0 18.7	26.4 19.8	27.7 20.8
6.00″					10.6 8.0	11.9 8.9	13.3 9.9	14.6 10.9	15.9 11.9	17.3 13.0	18.6 14.0	19.9 15.0	21.3 16.0	22.6 17.0	23.9 17.9	25.2 18.9	26.5 19.9
6.25″					10.2 7.7	11.5 8.6	12.7 9.5	13.9 10.4	15.2 11.4	16.5 12.4	17.8 13.3	19.1 14.3	20.4 15.3	21.6 16.2	22.9 17.2	24.2 18.1	25.5 19.1
6.50″						11.0 8.3	12.3 9.2	13.5 10.1	14.7 11.0	15.9 11.9	17.1 12.8	18.3 13.7	19.6 14.7	20.8 15.6	22.0 16.5	23.3 17.5	24.5 18.4
6.75″						10.6 7.9	11.8 8.8	13.0 9.8	14.2 10.7	15.4 11.6	16.5 12.4	17.7 13.3	18.9 14.2	20.1 15.1	21.3 16.0	22.5 16.9	23.7 17.8
7.00″						10.2 7.6	11.4 8.5	12.5 9.4	13.7 10.3	14.8 11.1	15.9 11.9	17.0 12.8	18.2 13.7	19.3 14.5	20.5 15.4	21.6 16.2	22.8 17.1
7.50″							10.6 7.9	11.6 8.7	12.7 9.5	13.8 10.3	14.8 11.1	15.9 11.7	17.0 12.8	18.1 13.6	19.2 14.4	20.2 15.2	21.3 16.0
8.00″								10.9 8.2	11.9 8.9	12.9 9.7	13.9 10.4	14.9 11.2	15.9 11.9	16.9 12.7	17.9 13.4	18.9 14.2	19.9 14.9
8.50″								10.2 7.6	11.2 8.4	12.2 9.1	13.1 9.8	14.0 10.5	15.0 11.2	15.9 11.9	16.9 12.7	17.8 13.4	18.8 14.1
9.00″									10.6 7.9	11.5 8.5	12.4 9.2	13.2 9.9	14.1 10.6	15.0 11.3	15.9 11.9	16.8 12.6	17.7 13.3

Above table of screen images figured on basis of sound-on-film aperture—0.800″ x 0.600″

FIGURED ON BASIS OF APERTURE

ON the preceding page is published for the first time a table showing the size of screen images at different distances with lenses of different focal lengths, computed on the basis of the sound-on-film picture aperture of 0.8000″ x 0.600″. This table was computed at the request of INTERNATIONAL PROJECTIONIST by the Scientific Bureau of Bausch & Lomb Optical Company, to whom this publication and all motion picture technical workers are indebted for this service. First publication of this table naturally is made exclusively in INTERNATIONAL PROJECTIONIST.

All such tables heretofore have been computed on the basis of the silent-film, or full-width, picture aperture the dimensions of which are 0.906″ x 0.6795″. Tables computed on this basis have had appended thereto a note stating that in its application to the reduced size (sound-on-film aperture), it would be necessary to substract 11 per cent from the dimensions of the screen picture as given in the table.

Apart from the fact that this percentage figure is not strictly correct (the figures being closer to 12 per cent), the necessity for such computation resulted in frequent, and often serious, error, loss of time and annoyance in general. This new table eliminates all this trouble and enables one to note at a glance the correct figures for any size screen image at any distance and with lenses of different focal lengths.

On the page following appears the table of screen images previously used and which is figured on the basis of the old standard silent-film aperture size. This table will provide an interesting comparison with the new table.

INTERNATIONAL PROJECTIONIST wishes to compliment Bausch & Lomb Optical Company for the readiness with which it rendered this service to projectionists.

PROJECTION TABLE SHOWING SIZE OF SCREEN IMAGES AT DIFFERENT DISTANCES WITH LENSES OF DIFFERENT FOCAL LENGTH

Size of Picture Aperture: 0.906″ x 0.6795″

E. F. in.	40 ft.	50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	120 ft.	130 ft.	140 ft.	150 ft.	160 ft.	170 ft.	180 ft.	190 ft.
2.00″	18.0	22.6	27.1	31.6	36.2	40.7	45.2									
	13.5	16.9	20.3	23.7	27.1	30.5	33.9									
2.25″	16.0	20.1	24.1	28.1	32.1	36.2	40.2	44.2								
	12.0	15.0	18.1	21.1	24.1	27.1	30.1	33.2								
2.50″	14.4	18.0	21.7	25.3	28.9	32.5	36.2	39.8	43.4							
	10.8	13.5	16.3	19.0	21.7	24.4	27.1	29.9	32.6							
2.75″	13.1	16.4	19.7	23.0	26.3	29.6	32.9	36.2	39.5	42.8	46.1					
	9.8	12.3	14.8	17.2	19.7	22.2	24.7	27.1	30.6	33.1	35.5					
3.00″	12.0	15.0	18.0	21.0	24.1	27.1	30.1	33.2	36.2	39.2	42.2	45.2				
	9.0	11.3	13.5	15.8	18.1	20.3	22.6	24.9	27.1	29.4	31.7	33.9				
3.25″	11.1	13.9	16.7	19.4	22.2	25.0	27.8	30.6	33.4	36.2	39.0	41.7	44.5			
	8.3	10.4	12.5	14.6	16.7	18.8	20.9	22.9	25.0	27.2	29.2	31.3	33.4			
3.50″	10.3	12.9	15.5	18.0	20.6	23.2	25.8	28.4	31.0	33.5	36.0	38.7	41.3	43.9	46.5	
	7.7	9.7	11.6	13.5	15.5	17.4	19.4	21.3	23.2	25.1	27.0	29.0	31.0	33.0	34.9	
3.75″		12.0	14.4	16.8	19.3	21.7	24.1	26.5	28.9	31.4	33.8	36.2	38.6	41.0	43.4	45.8
		9.0	10.8	12.6	14.4	16.2	18.1	19.9	21.7	23.5	25.3	27.1	28.9	30.8	32.6	34.4
4.00″		11.3	13.5	15.8	18.0	20.3	22.6	24.8	27.1	29.4	31.6	33.9	36.2	38.4	40.7	43.0
		8.5	10.1	11.8	13.5	15.2	16.9	18.6	20.3	22.0	23.7	25.4	27.1	28.8	30.5	32.2
4.25″		10.7	12.8	14.9	17.0	19.2	21.2	23.4	25.5	27.6	29.8	31.9	34.0	36.2	38.3	40.4
		8.0	9.6	11.2	12.8	14.4	15.9	17.5	19.1	20.7	22.3	23.9	25.5	27.1	28.7	30.3
4.50″		10.1	12.1	14.1	16.1	18.1	20.1	22.1	24.1	26.1	28.1	30.1	32.1	34.1	36.2	38.2
		7.6	9.1	10.6	12.1	13.6	15.0	16.6	18.1	19.6	21.1	22.6	24.1	25.6	27.1	28.6
4.75″			11.4	13.3	15.3	17.2	19.0	20.9	22.8	24.7	26.6	28.5	30.4	32.3	34.3	36.2
			8.6	10.0	11.5	12.9	14.3	15.7	17.1	18.5	20.0	21.4	22.8	24.3	25.7	27.1
5.00″			10.9	12.7	14.5	16.3	18.0	19.9	21.7	23.5	25.3	27.1	28.9	30.7	32.5	34.4
			8.2	9.5	10.9	12.2	13.5	14.9	16.2	17.6	19.0	20.3	21.7	23.0	24.4	25.8
5.25″			10.3	12.0	13.7	15.5	17.2	18.9	20.6	22.4	24.1	25.8	27.5	29.3	31.0	32.7
			7.7	9.0	10.3	11.6	12.9	14.2	15.5	16.8	18.1	19.4	20.7	22.0	23.2	24.5
5.50″				11.5	13.1	14.7	16.4	18.0	19.7	21.3	23.0	24.6	26.3	27.9	29.6	31.2
				8.6	9.8	11.1	12.3	13.5	14.8	16.0	17.2	18.5	19.7	20.9	22.2	23.4
5.75″				11.0	12.5	14.1	15.7	17.3	18.8	20.4	22.0	23.6	25.1	26.7	28.3	29.9
				8.2	9.4	10.6	11.8	12.9	14.1	15.3	16.5	17.7	18.8	20.0	21.2	22.4
6.00″				10.5	12.0	13.5	15.0	16.5	18.0	19.6	21.1	22.6	24.1	25.6	27.1	28.6
				7.9	9.0	10.1	11.3	12.4	13.5	14.7	15.8	16.9	18.1	19.2	20.3	21.5
6.25″				10.1	11.5	13.0	14.4	15.8	17.3	18.7	20.2	21.6	23.1	24.5	26.0	27.4
				7.6	8.6	9.7	10.8	11.9	13.0	14.1	15.2	16.3	17.3	18.4	19.5	20.6
6.50″					11.1	12.5	13.9	15.3	16.6	18.0	19.4	20.8	22.2	23.6	25.0	26.4
					8.3	9.4	10.4	11.4	12.5	13.5	14.6	15.6	16.7	17.7	18.8	19.8
6.75″					10.7	12.0	13.3	14.7	16.0	17.4	18.7	20.1	21.4	22.7	24.1	25.4
					8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.1	18.1	19.1
7.00″					10.3	11.6	12.9	14.2	15.5	16.8	18.0	19.3	20.6	21.9	23.2	24.5
					7.7	8.7	9.7	10.6	11.6	12.6	13.5	14.5	15.5	16.4	17.4	18.4
7.50″						10.8	12.0	13.2	14.4	15.6	16.8	18.0	19.3	20.5	21.7	22.9
						8.1	9.0	9.9	10.8	11.7	12.6	13.5	14.4	15.3	16.3	17.2
8.00″						10.1	11.3	12.4	13.5	14.6	15.8	16.9	18.0	19.2	20.3	21.4
						7.6	8.4	9.3	10.1	11.0	11.8	12.7	13.5	14.4	15.2	16.1
8.50″							10.6	11.6	12.7	13.8	14.8	15.9	17.0	18.0	19.1	20.2
							7.9	8.7	9.5	10.3	11.1	11.9	12.7	13.5	14.3	15.1
9.00″							10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0
							7.5	8.2	9.0	9.8	10.5	11.3	12.0	12.8	13.5	14.3

The above table of screen images, figured on the basis of the silent-film aperture, will make an interesting comparison with the table which appears on the page opposite.

LINE VOLTAGE REGULATOR SOUND SYSTEM NECESSITY

MANY sound equipment amplifiers are designed to operate on 110 volts A. C. In many localities the voltage varies bewteen 90 and 130 volts, depending upon the locality, the load upon the line, transformer equipment, time of day, and other factors beyond the control of the power company and the designer of the apparatus. Thus the actual voltage applied to a sound amplifier may vary within wide limits, either momentarily, due to a sudden heavy load upon the line, or steadily, as in the case of a voltage drop due to a long transmission line.

Vacuum tubes operated below the specified voltage provide poor tone quality and weak volume. High line voltage will result in distortion, and also will cause serious injury to the amplifier's component parts, such as transformers, resistors, and vacuum tube filaments. If the line voltage maintained a drop in volt-

age, it might be compensated for by the use of a properly designed low-voltage transformer.

Unfortunately, however, alternating current line voltages rise as frequently as they drop, making it imposible to employ low-voltage transformers, since any increase above normal would seriously overload the vacuum tubes and component parts. The tapped transformer with a choice of two or more voltage ranges, adopted by some sound equipment manufacturers, was a half-way improvement. It was a relief measure, but by no means a cure, being unable to cope with line voltage fluctuations.

There are several types of voltage regulators on the market, all intended for the same purpose. Some cover wide limits and others do not cover wide enough limits.

Fox West Coast Theatres have adopted for use a special voltage regulator which consists of a step-up and step-down transformer, a fixed resistance and a voltmeter. This type of voltage regulator operates on the automatic compensation principle: The voltage may be regulated at any time, so that a normal voltage of 110 volts may be obtained. After the voltage regulator is once set, the series resistance maintains the applied voltage at correct and uniform value irrespective of line voltage variations, fluctuations and surges.

When the line voltage is high, the resistance is likewise high, causing necessary voltage drop for safe-guarding the vacuum tube filaments and the component parts of the amplifier, such as filter condensers, resistors and power transformers. When the voltage is normal or sub-normal, the resistance is slight, causing small voltage drop. This resistance also serves as a choke, thus reducing line noises to a minimum. Incorrect grid bias, incorrect plate voltages, incorrect input and output voltages, have been the cause for poor sound reproduction with many sound installations.

Reasonable Care Will Prevent Extraneous Reproduction Noise

BEFORE describing specific noises and causes, an anlaysis and classification of the various types of noises may be of assistance. Insofar as the projectionist is concerned, noise may be classified in two general groups: (1) That originating in the projection room or in the sound system, and (2) that which has its origin in other sources, such as ventilating systems, audience noise or street noise.

The first of these groups may be further classified under three general headings: The first comprises those noises which reach the audience by direct transmission through the air from the projection room itself. Such noises include the noise of rotating machinery, loud conversation, high monitor horn volume and other noises incidental to the operation of the projection equipment.

The second group includes noises of an intermittent character that are introduced into the sound system electrically, such as might be caused by loose contacts, defective fuses or run-down batteries.

The third includes noises which also are introduced into the sound system electrically, but which are more or less steady, such as the "rush noise" from the photo-electric cell, hums from A. C. pickup, and noise resulting from the electrical transmission of mechanical vibrations.

Although noises from any source will prove distracting to an audience, this is especially true of mysterious noises coming from directions other than the screen. Noises coming from the direction of the screen are generally not so objectionable, especially if they are of such a nature that they may be interpreted as originating in the action.

Those noises reaching the audience through the air from the projection room can be prevented, or at least reduced to the point where they are no longer objectionable.

Except in an emergency, loud conversation between projectionists is quite unnecessary. If the projection room is not thoroughly sound proof, the projectionists' conversation, even if not abnormally loud, will be heard by those seated in the rear of the audience. Reasonable care on the part of the projectionists will prevent criticism on this point.

Loud operation of the monitor horn is likewise very annoying to the audience. The monitor is not intended for use in judging quality or volume of the sound in the auditorium. This is a duty which can be performed satisfactorily only by observation in the auditorium.

Careful Handling

In the handling of film the careful projectionist can do much to reduce the noise originating in the projection room. Although enclosed motor-driven rewind machines are not usually excessively noisy, the ordinary hand-operated machine can be, especially when operated at a high speed. If, however, it is operated slowly enough to permit careful inspection of the film for oil spots, worn sprocket holes, and insecure patches, there will be little possibility of objectionable noise.

Reels which have been bent out of shape frequently strike against magazine walls, and their continued use should be avoided. The slamming of magazine and lamphouse doors and the occasional dropping of empty film cans are also sources of noise which are to be guarded against. Automatic changeover devices are sometimes noisy, as are also manual changeovers, if carelessly operated. Another source of occasional disturbance is the striking of the arcs in preparation for a changeover. However, the experienced projectionist will have little difficulty from this source.

The noises described thus far are practically all under the direct control of the projectionist, who can prevent their occurrence or minimize their extent by the exercise of reasonable care in the operation of his equipment.

Due to the fact that they contain gears, drives and other rotating parts, projectors contribute their share in adding to the general noise originating in the room. Assuming that the equipment is properly designed and manufactured, the reduction of noise from it becomes largely a question of careful maintenance. Proper lubrication is the first step in preventing wear and noise. Although the instructions issued by the manufacturer should carefully be followed in lubrication, it is in general true that the more frequent use of less oil is more effective than its use in larger quantities at less frequent intervals would be, because of the reduction of the danger of seepage from parts on to the film due to an excess at any one time.

Gear Noise

Gears which show sign of excessive wear should be replaced, since in addition to causing noise, considerable vibration may be set up which may be picked up by the sound system. Universal joints and flexible couplings should be frequently inspected to insure that they are not binding and thus setting up increased vibration and therefore noise.

Many of the larger theatres and theatre chains make it a practice to completely rebuild projector heads at least once a year. This represents good insurance against breakdown and noisy operation.

Careful glassing-in of the room portholes and lookouts will go far in reducing the amount of noise which reaches the audience directly from the room. Vibratory noises originating in the room and transmitted to the auditorium through its walls and floor may be especially difficult to overcome. However, a careful survey by a reliable acoustic consulting service will usually indicate what steps should be taken to reduce interfering noise in any cases of this kind.

MOTION PICTURE SCREENS—METHODS OF SELECTION AND MAINTENANCE

Francis M. Falge

[The following paper, prepared by Francis M. Falge of the Beaded Screen Corp., New York, N. Y., was presented in the Symposium on Theatre Practices at the Spring, 1931, Meeting of the S.M.P.E. in Hollywood. Much valuable data on motion picture screen surfaces and their care is contained herein. Comment by projectionists on certain phases of this paper is invited.]

PICTURE presentation, especially since the advent of sound, is fraught with many difficulties, and the screen is by no means the least of these. The overcoming of all other difficulties—the light source, the film, the lenses, etc.—may all be for naught if the last one, the screen, should interfere. But the exhibitor often little realizes the importance of the screen. His projectionists take care of all other equipment, but even they allow a dirty or imperfect screen to pass without comment. This not only means a loss of efficiency, but a loss at the box-office as well, because of dissatisfied patrons.

When selecting a screen the following points, which will be discussed individually, should be considered:

(1) Adaptability to the particular theatre
(2) Reflective efficiency
(3) Sound characteristics
(4) Durability
(5) Uniformity
(6) Fireproofing
(7) Illusion of depth
(8) Adaptability to color
(9) Size of screen required

There are many kinds of screens, but all come within three general classifications. There is no screen made today which is an average type best suited to all houses. For that reason, screens should be selected which fit the characteristics of the particular house, bearing in mind the fact that theatres have very dissimilar characteristics. Theatres may vary in width from 20 to 120 feet or more, and in length from 50 to 150 feet. They may have no balcony or they may have three; the angle of projection may be zero or it may be 35 degrees, and the screen may be from 10 to 30 feet from the front row of seats.

Types of Screens

There are three general types of screens:

(*a*) Diffusive or matte
(*b*) Reflective or metallic
(*c*) Directive or beaded

All three types of screens are made with openings to permit the passage of sound.

Fortunately, screen characteristics are so definite that consideration of the vital principles of each of these types should permit a ready decision as to the screen best suited to a particular house.

Practice seems to bear out the fact that a matte screen which radiates equally in all directions appears less brililant the farther away the observer is from it. This may be due to the loss of light through the atmosphere, a smaller included angle of light, and the interference of light sources in the house. These factors in general tend to make the screen too brilliant for those in the front rows of seats, and not sufficiently brilliant for those in the rear seats. When selecting a screen, consideration should be given to these points.

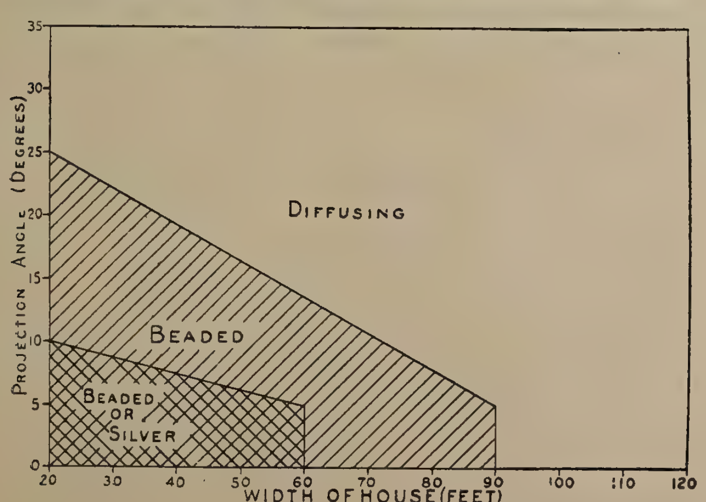
(*a*) *The Diffusive Screen.*—Diffusive screens are made of cellulose coated materials; rubberized fabrics; closely woven treated materials; coarsely woven materials with or without metallic fibers; woven materials with irregular glass particles; and coated metals. The distribution of light from a typical diffusive screen is shown in Fig. 1. The curve including the largest area, indicating the largest reflection values, is, in general, the best.

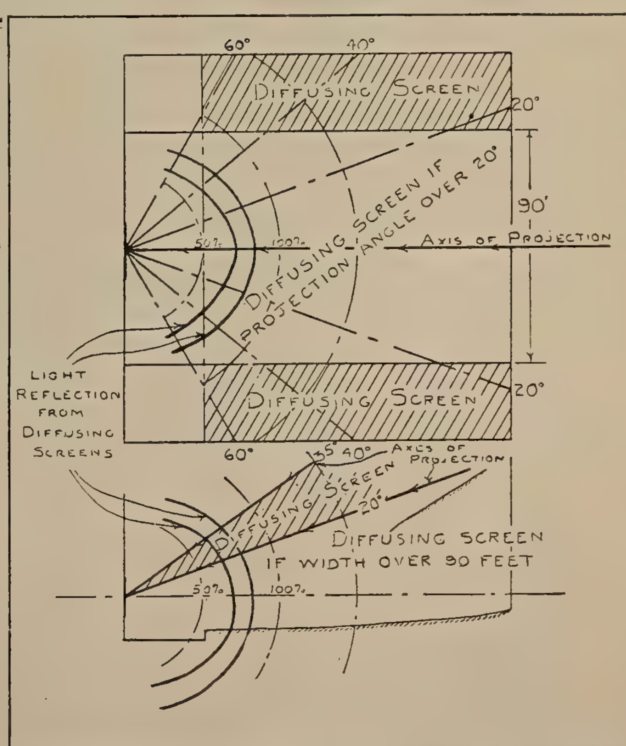
The advantages of diffusive screens may be listed as follows:

(1) They redirect a large percentage of light—*i.e.*, they are very efficient.
(2) They are good for color picture projection—*i.e.*, they are not color-selective
(3) They redirect light through wide angles, giving satisfactory projection for wide theatres or for theatres with steep projection angles

Fig. 1 — Characteristics of diffusive screens

Fig. 2—Showing relations between theatre width and projection angle





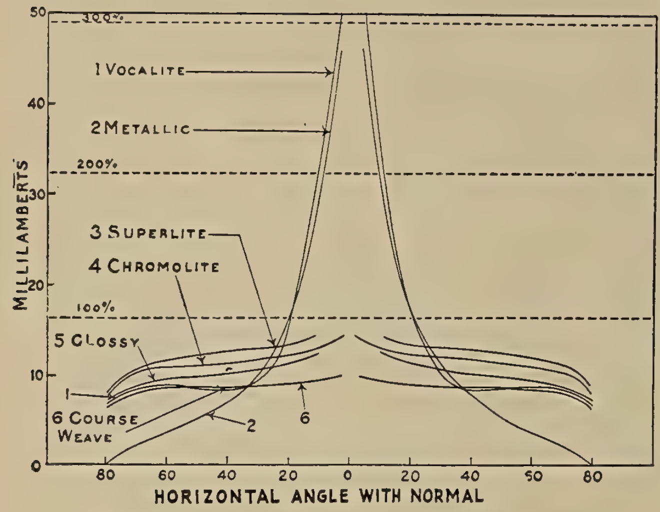


Fig. 3—Brightness characteristics of various screens

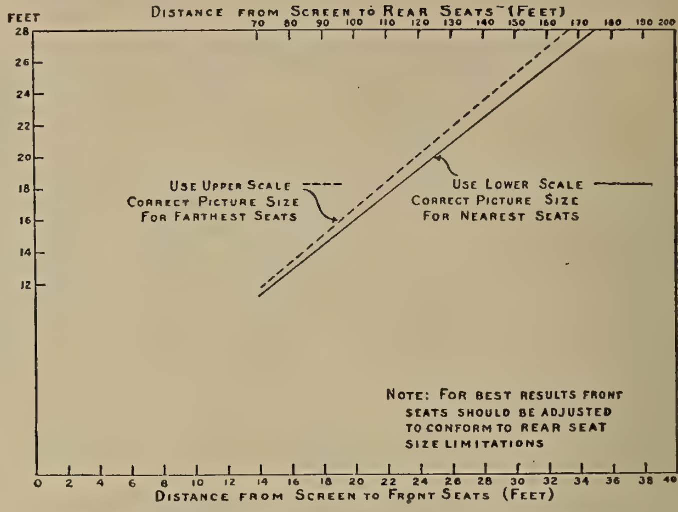


Fig. 4—Curves for determining proper size of picture

(*b*) *The Reflective Screen.*—Reflective screens are made of aluminum and other polished and coated materials, and have varying degrees of diffusiveness.

Their advantages may be listed as follows:

(1) They build up the intensity of the reflected light so that under certain conditions they add to the apparent brilliancy as viewed from the rear seats

(2) Their use results in economies in proprojection houses which have large ratios of length to breadth

The disadvantages of reflective screens are:

(1) They are not desirable where the angles of projection are greater than 10 degrees

(2) They can be used in relatively few houses

(3) They are not satisfactory for the projection of colored pictures—*i.e.*, they are color-selective.

We may conclude, therefore, that reflective screens are useful for few houses because of prevalent conditions and their limited reflection angles. Also, they are not good for color picture projection.

(*c*) *The Directive Screen.*—Directive screens are diffusing screens on which are imbedded glass globules; they are also called "beaded screens." Their advantages may be listed as follows:

(1) They build up the intensity of the reflected light so that a more brilliant picture can be seen from the rear seats

(2) They redirect the light so that to spectators in the balcony the picture appears as good as to those on the main floor

(3) They redirect the light in such a manner as to result in decided economies

(4) They assist in the illusion of the third dimension

(5) They can be satisfactorily maintained, and retain much of their original brilliancy

(6) They reduce the glare seen from seats near the screen

(7) Because of their apparent brightness, they add life and brilliancy to color pictures

The disadvantages of directive screens are:

(1) They are not desirable for theatres having projection angles greater than 20 degrees because of their directive nature

(2) They are not desirable for wide houses

In conclusion it may be stated that beaded screens, while very efficient, redirect the light and provide a more satisfactory picture in houses of medium width having projection angles up to 20 degrees. Because of the great brilliancy and the decided contrasts, the tone qualities of the picture are enhanced, especially in the case of color pictures. Beaded screens also redirect the light so as to provide those in the balcony with as good a picture as those on the main floor.

Selection of a Screen

Invariably, it is a mistake to select a screen for one theatre by viewing a screen in another theatre. The many whims of projection equipment all contribute to mislead the observer, and in the final analysis, the characteristics of the houses will probably differ so much that a proper choice is impossible. Then, too, our eyes are not trained to evaluate the brightnesses in cases such as these.

Consideration of the foregoing analysis, the charts of Fig. 2 and Fig. 3, and the physical characteristics of the particular theatre for which the screen is intended, will permit the selection of the best type. The other factors which follow will assist in making the proper selection of the best screen of that type.

The total reflection of light from a screen, apart from measurements of its reflection characteristics in various directions, is very important, as it is on this factor that one phase of efficiency depends. Of two similar types of screen, the one with the highest over-all efficiency is likely to prove best. This is illustrated in Fig. 1, where the largest curve indicates the most efficient screen. The reflective efficiency of the screen is closely linked with the reffective efficiency of the coating material, titanium pigment being an excellent white reflective pigment. Aluminum, on the contrary, has relatively low efficiency, and consequently metallic screens are usually of low efficiency. Light tests of screens should include measurements of reflective efficiency.

In practically all cases, horns are now placed behind the screen, the sound passing through the screen *via* interstices in woven cloth or perforations in opaque material. When this method was first used, the matter of sound transmission was considered all-important, compared with other considerations, and the picture suffered decidedly. It was later found that a relatively small percentage of open space—as low as 4 per cent—could be used, the present compromise being about 8 per cent. An arbitrary figure of approximately 3 decibels loss was decided as allowable by Electrical Research Products, Inc. RCA Photophone, Inc., and other manufacturers have allowed somewhat greater tolerances. Considering the great losses in other parts of the system, such as in the horns, the allowable loss for screens would seem rather severe, but fortunately, a fairly good picture can be produced on a screen meeting this requirement. Also because of varying methods of test, it does not seem possible to make two tests that check, so that, under the present system, the value of these tests is questionable.

Screen Durability

Under this subject the following factors must be considered:

(*a*) The ability of the screen to withstand abuse, during handling and hanging

(*b*) Its strength at the seams

(*c*) The effect of dirt collection

(*d*) The effect of washing and reprocessing

The abuse that the average sound

Description	Picture	Screen	Inside of Frame
Standard	9′0 by 12′	9′6 by 12′6	10′6 by 13′6
Substandard	10′6 " 14′	11′0 " 14′6	12′0 " 15′6
Standard	12′0 " 16′	12′6 " 16′6	13′6 " 17′6
Substandard	13′6 " 18′	14′0 " 18′6	15′0 " 19′6
Standard	15′0 " 20′	15′6 " 20′6	16′6 " 21′6
Substandard	16′6 " 22′	17′0 " 22′6	18′0 " 23′6
Standard	18′0 " 24′	18′6 " 24′6	19′6 " 25′6
Magnoscope	24′0 " 36′	25′0 " 37′0	26′0 " 38′0
"	26′0 " 40′	27′0 " 41′0	28′0 " 42′0
"	28′0 " 40′	29′0 " 41′0	30′0 " 42′0

Table A

screen receives is astonishing. When hanging the screen, often too little care is taken, and there is always the possibility of tearing or damaging the surface. Ruggedness or material is a factor to consider in selecting a screen, but any screen is likely to suffer because of abuse. Furthermore, ruggedness seems to play no part in its life, as other factors, such as the collecting of dirt and method of maintaining the screen, are more important. The seams should be as strong as possible, but no seams will withstand considerable abuse.

Uniformity

The accumulation of dirt, the washing of the screen, and methods of reprocessing it are the factors which determine the life of a sound screen. If properly maintained, screens may have an effective life of one and one-half to two years. The average effective life of a sound screen is one year; screens kept in service longer than this handicap the exhibitor to a considerable extent unless they are properly and regularly serviced.

Two factors must be considered under this heading: (*a*) the uniformity when new, and (*b*) the uniformity after being used a while and after cleaning or reprocessing.

The slightest imperfection in weave or variations in depth of coating may result in a non-uniform surface; this may happen even when the greatest of care is taken. Panels must therefore be carefully matched and inspected to see that they are of the same color and are free from imperfections. The processing must be so uniform and exact that surface conditions and time will not cause a lack of uniformity. All screens in use today become yellow with age to a certain extent. If the yellow is uniform, it is not likely to be objectionable. Improper cleaning or reprocessing may introduce streaks and imperfections, and may considerably increase the tendency to become yellow. At the time of processing, the screens may have a uniform appearance, but when dry the imperfections will gradually appear. Be sure that this is given consideration before allowing a screen to be resurfaced.

Some time ago, because screens were made of highly inflammable cellulose materials, considerable agitation was raised in certain quarters concerning fireproof screens. By adding certain ingredients and eliminating others, the various screen coatings were made fire-resistant. Fabrics are best made fireproof by impregnating them. A slow-burning material, however, when stretched vertically, does not constitute a fire hazard; but if a fire-resistant material is selected, there need be no fear of objection by local inspectors.

Successful fireproofing of a screen immediately after it is made or while in place in the theatre has not yet been accomplished. Screens are such a small item of the stage equipment, and so much less inflammable, that there need be no fear of fire from them. In general, it is best for each exhibitor to choose his screen according to his local ordinances.

The illusion of depth is a very debatable matter; it seems to be connected with the method of photography used. By obtaining the proper contrast between highlights and shadows, an illusion of depth seems to be created. Beaded screens have been selected for wide film projection in a number of instances because of this feature.

Adaptability to Color

Color brilliance and purity is, to a considerable extent, dependent on the light intensity. For this reason a bright screen will, in general, if of neutral character, give better results for all colors than a screen which is less bright. For colors, screens should have no tint other than that which is required to neutralize the color of the light source, assuming that it has a definite color. A metallic screen is usually quite color-selective, whereas beaded and white diffusive screens are neutral in character. Closely paralleling this problem is that of obtaining the correct tone quality of the reflected picture. Attempts to tint the screens in order to impart a certain tone quality to the picture are likely to be undesirable when colored pictures are projected, and because of the different qualities of the various arc sources themselves.

Size of Screen

The problem of choosing the proper size of screen is an important one. A new installation is the simplest to plan, but when a theatre needs a new screen, the problem should be carefully considered. The problem is of sufficient importance to warrant the replacing of the objective lens if a different size of screen seems desirable.

Standard Sizes.—A system of standard screen sizes is highly desirable, and will result in economies and other advantages for both the exhibitor and the manufacturer. Less wastage results, errors in ordering are made less frequently, shipping is expedited, cleaning is facilitated, and costs and prices are consequently reduced. The Projection Screens Committee of the Society of Motion Picture Engineers is now developing recommendations for standard sizes. Information based on standards adopted individually by large circuits and manufacturers gives the list of sizes shown in Table A.

Wherever possible a standard size should be substituted for a non-standard. When ordering screens, the three dimensions should be given; prices are based on picture sizes.

House Conditions

Theatres are planned with definite lines of sight, and care must be taken to keep the screen in the line of vision, especially when using a screen modifier. Older theatres generally used a line of sight which provided a clear view of 16 feet from the stage floor at a point 4 feet back of the curtain line, which therefore often limited the size of the screen to 15 by 20 feet. Newer theatres often allow for a considerably greater height.

The distance from the front row of seats to the screen is one of the determining factors for the size of the screen. The larger the picture, the worse will the imperfections, such as graininess in the film, appear. These imperfections are very noticeable and objectionable to

(*Continued on page* 39)

Light Source	Screen	Throw	Picture
Mazda	Diffusive	100 ft.	12 × 16
"	Beaded	100 "	15 " 20
Low Intensity	Diffusive	125 "	15 " 20
Low Intensity	"	175 "	12 " 16
" "	Beaded	125 "	18 " 24
" "	"	175 "	18 " 24

Table B

TELEVISION NEWS NOTES

Prospects for Television in the Theatre

THE projectionist is primarily concerned with television from the standpoint of how soon, and in what form, it will enter the motion picture theatre. To determine the extent to which television will affect the motion picture houses, this department completed an exhaustive survey of moving picture producers and exhibitors, as well as other organizations directly interested in television as a possible box office attraction.

The results of the survey revealed a general opinion that television will not be utilized, to a widespread extent, in motion picture theatres. If television does come into the movie houses, it will be from three to five years after it becomes general in the home.

Television most practical possibility, insofar as the cinema is concerned, is best expressed by the spokesman for a large television company, who says: "It is our belief that in the near future a great number of theatres will subscribe to a wire service for news television. These pictures will be picked up at the ring side, at the ball field, at the scene of important events, and so on. The pictures will be flashed over a group of telephone wires to various subscribing theatres. In this way it will be possible for audiences to follow news events at the very time they are taking place. This is in contrast to the usual news reels which cannot be made available much under twelve hours from the time they are made."

Television as a Good Investment Prospect

SOME of the financial interests are suggesting television as an attractive investment possibility. Between 25,000 and 30,000 sets are said to be in daily use in this country.

The potential market for television sets has been estimated at 1,000,000 by 1933. By the end of the next decade, statisticians say, more than 11,000,000 television receivers will be in domestic use. One financial forecasting service reports that television stocks are moving opposite the downward trend and predicts that when the general market begins to show activity, television shares will move rapidly to the front.

DeForest Direct Pick-Up Television Camera

THE accompanying illustration shows the new direct pick-up television camera designed and built by the De-

New De Forest direct pick-up camera for television work

Forest Radio Company. The light is reflected from the performer through the lens and the 60-hole scanning disc, which is encased in the circular housing, to the photo-electric cells, which are in the box on the top of the camera. The image is monitored through the shadow box on the side of the photo-cell case, the operator seeing the image on a Neon lamp from which two wires lead. Thus the monitor sees the image in the same form as does the television audience. The camera is very flexible, may be moved about, raised, tilted and turned horizontally, and, when mounted on a truck, be used for outdoor televising.

The direct pick-up camera is claimed to be an important forward step that will overcome difficulties heretofore attached to televising because of the lack of light.

The idea of the direct pick-up camera is not new but is an elaboration of former attempts, chiefly to the extent of developing a more sensitive photoelectric cell and the more practical use of the screen-grid high-gain amplifying tubes.

The Major Problem in Television Work

ASIDE from the numerous improvements necessary in sending and receiving sets, television's broadcast problem at present is similar to that which has confronted radio all of these years: —there must be an adjustment of wave lengths to allow for more distance and fewer interferences.

Short wave transmission, for both radio and television, is considered by experts to be the solution to the problem. This

LIST OF TELEVISION STATIONS

Call Letters	*Location*	*Owner*
W2XCR	New York, N. Y.	Jenkins Television Corp.
W3XK	Wheaton, Mr.	Jenkins Laboratories
W2XCD	Passaic, N. J.	DeForest Radio Corp.
W2XBU	Beacon, N. Y.	Harold E. Smith
W9XAO	Chicago, Ill.	Western Television Corp.
W2XAP	Portable	Jenkins Television Corp.
W3XAD	Camden, N. J.	RCA Victor Co.
W2XBS	New York, N. Y.	National Broadcasting Co.
W2XCW	Schenectady, N. Y.	General Electric Co.
W8XAV	Pittsburgh, Pa.	Westinghouse Electric Co.
W2XR	Long Island, N. Y.	Radio Pictures, Inc.
W9XAP	Chicago, Ill.	Chicago Daily News
W3XAK	Bound Brook, N. J.	National Broadcasting Co.
W2XAB	New York, N. Y.	Columbia Broadcasting System
W9XAA	Chicago, Ill.	Chicago Federation of Labor
W9XG	West Layfayette, Ind.	Purdue University
W2XBO	Long Island City, N. Y.	United Research Corp.
W1XAV	Boston, Mass.	Shortwave and Television Lab.
W9XR	Downer's Grove, Ill.	Great Lakes Broadcasting Co.
W6XK	Los Angeles, Cal.	Don Lee, Inc.
W9XD	Milwaukee, Wis.	The Milwaukee Journal
W2XB2	New York, N. Y.	National Broadcasting Co.

Note: W2XR (Radio Pictures, Inc.); W3XAD (RCA Victor Co.); and W1XAV (Short Wave and Television Lab.), each televise on two bands.

form of broadcasting will greatly ameliorate objectionable interferences and increase the broadcasting range. At the same time, short wave sending and receiving will make it possible to use one set for both sight and sound programs, instead of a set for each purpose, as is now necessary.

Radio Corporation's Plans for Television Theatre

ALTHOUGH Radio Corporation and its affiliated companies, of which RKO is a unit, are making few public announcements as to their progress with, and plans for, television, specifications for Radio City provide for the installation of television equipment in their 3,500-seat motion picture theatre.

It was in the RKO Proctor Theatre in Schenectady that on May 22 of last year, television was seen for the first time as part of a regular performance in a motion picture theatre.

World's Highest Structure As Aid to Television

THE National Broadcasting Company has installed television equipment for experimental purposes on the eighty-fifth floor of the Empire State Building, the world's tallest structure. The television studios and laboratories will occupy the east half of the eighty-fifth floor, approximately one thousand feet above the street, and it is believed that operation of apparatus at this height above the city will be helpful in surmounting the difficulties which have beset television transmission in the past. A television antenna will be at the top of the Empire State mooring mast, one thousand two hundred and fifty feet above the street level.

The new television studios and laboratory are one floor below the Empire State observatory, the highest usuable space of the building. The engineers working there will have the distinction of being the highest technical workers anywhere in the world, their quarters being even loftier than the summit of the Eiffel Tower in Paris, the second tallest structure in the world.

Who Will Pay the Television Bill?

WHO will pay the bill incident to putting television before the public? In expressing his opinion on the subject in "Radio in Advertising" (Harper and Brothers), Orrin E. Dunlap, Jr., Radio Editor of the New York *Times*, asserts that the burden will fall on the shoulders of the big advertisers.

"There is no evidence," according to Mr. Dunlap, "that advertisers will shrink from the television performance. They are preparing to grasp it as they have radio.

"Television will permit demonstrations, and the audience will not have to imagine what a product looks like or how it operates," says Mr. Dunlap in his book. "A new model automobile revolving on a turntable in front of a televisor will enable it to be introduced to the entire nation within a few stconds. . . . Great will be the power of television in advertising if for no other reason that the fact that one picture is worth more than 1,000 words!

"Showmen and experts in color effects will be in demand. The radio dramas and concerts in many instances will be broadcast from films prepared in studios in much the same way that talkies are made. There will be news events flashed by radio cameras on the scene of action, whether it be a Presidential inauguration or a prize fight."

Survey Answers Problem of Replacement Variations

THERE has always been considerable speculation on the part of theatre owners and equipment manufacturers regarding the reason for the great variation in the number of replacements of parts for sound reproducing equipment. Even among theatres using the same type equipment and running the same number of hours the parts replacement figures vary widely—so much so, that one leading manufacturer of sound reproducing equipment decided upon a survey to establish definitely the reason for this seemingly mysterious circumstance. The survey provided a simple answer to the problem. . . . But to go on with the story.

Twenty theatres, representing the various type of sound systems and providing a cross-section of the exhibiiton field, were selected for the survey work. A preliminary investigation was carried out and it was found that the theatres which had the least replacements were controlled by exhibitors who had no complaints to make and always got on exceptionally well with the service engineers as well as with the trade in general. Although this did not immediately answer the question, it occasioned a study of the personnel and management.

Nothing was learned from the theatre itself. Although the physical characteristics of the auditorium could affect the quality of reproduction, they had no influence on the actual running of the equipment itself.

The study of the projection room and apparatus therein marked the first step toward the solution of the question. It was found that the theatre with few replacemens had an immaculate projection room, and the apparatus was invariably spotless. Every little detail was carefully looked after, even to cleaning all carbon dust from inside the lamp house. The generator room was well kept and there was no dust on or about the generator itself. Everything was well polished and properly lubricated, with the superfluous oil wiped off. A check-up of this type of theatre showed that every detail was carefully watched so that no slip might spoil an otherwise perfect performance.

The theatres with heavy replacements costs were not so pleasant a study. The apparatus was usually found clean on the surface, but the details had been overlooked. Minor adjustments were far from perfect, and the small corners were usually full of dust and the lamphouses full of carbon dust and small unburnt ends. The inside of the projectors were anything but free from grease and dirt.

The surveyors were then satisfied as to the reason for variation in the number of replacements, but continued to study further to ascertain if possible why one group of projectionists should take morc interest in their work than another.

This finally reflected to the managements. It was found in practically every case that the condition in the projection room varied directly with the policy of the management. The theatre with few replacements and spotless projection room was always well-managed and well-patronized. The theatres lacking good management also lacked tidiness, good business and organization.

PETER J. BRADY

WHILE flying to Detroit, Mich., where he was to address the American Legion Convention as a representative of the American Federation of Labor, Peter J. Brady, President of the Federation Bank and Trust Company of New York, was instantly killed when the plane in which he was a passenger crashed through a house on the outskirts of New York City. Mr. Brady was associated with the Photo-Engravers' Union and for a number of years was President of the New York Allied Printing Trades Council. In 1923 he organized the Federation Bank and Trust Company in the interests of the workingman, which institution has prospered and branched out under his capable leadership.

The passing of Mr. Brady is keenly felt by officials of the I.A.T.S.E. with whom an intimate friendship had been formed in the business dealings transpiring between the Alliance and the Federation Bank and Trust Company.

NEWS FROM THE SCIENCE WORLD

A NEW "PERPETUAL MOTION" DYNAMO SHOWN IN GERMANY

A NEW electric dynamo which either is a fake or is the most revolutionary electric discovery of a generation is attracting attention in Germany. Probably it is a fake, like the famous Keely motor and hundreds of others, for it apparently produces more power than is supplied to it, which amounts to perpetual motion and is contrary to all accepted theories of power and energy.

Invented by Herr Paul Hoffmann, of Steglitz, the new dynamo has been tested, it is claimed by the inventor, by engineers of the larger German electrical companies, by university professors, and by engineers in Sweden and Denmark. All agree, the claim is, that the power generated is 120 to 125 per cent of the power that is put in—which means, in engineering terms, an efficiency of 120 to 125 per cent. One hundred per cent efficiency, on the other hand, is regarded as the limit of perfection. Actual dynamos always have smaller efficiencies, ranging from 75 to 90 per cent.

The performance of the new machine is not ascribed by its inventor to actual perpetual motion; everyone knows better nowadays than to deny the firmly established scientific principle that this is impossible. Herr Hoffmann suggests, on the other hand, that his device taps some source of energy hitherto unknown. Engineering skeptics probably will wait for someone to discover the actual source of power, fed secretly into the machine.

NOW—PATENTS ON PLANTS

A new Federal law has been passed to provide for patents on plants; the first protection of this sort having been granted in August to cover a new type of ever-blooming rose. For the most part, the possibility of patent rights being granted to a plant grower depends upon his producing an original plant by a sexual method, "that is, by grafting, budding, cutting, layering or division." The same 17-year period of protection applying to mechanical devices also applies to patents on plants.

The decision as to whether or not a plant is patentable is determined in the routine manner by the Patent Office, in conjunction with the Department of Agriculture, by means of written applications and specifications, drawings and samples.

NOVEL CURE FOR HAYFEVER

Sunburning the inside of one's nose to cure hayfever is a medical procedure introduced recently in Austria by Dr. A. J. Cemach, of the Mariahilfer Hospital. Tilting the patient's nose up to the sun is scarcley practicabe, Dr. Cemach agrees, nor are the usual types of artificial, ultraviolet-ray lamps suitable for use inside the delicate tissues of the nose. What has proved to be practicable is a thin rod of fused quartz or rock crystal, into which powerful ultra-violet rays from a mercury lamp are introduced at one end and come out at the other. Workers with such quartz rods already have found that rays thus fed into one end will stay inside until they reach the other end, like water in a pipe.

In Dr. Cemach's method, the end of the quartz rod from which the rays emerge is introduced into the patient's nostril and pushed back gently to the extreme back part of the nose. The ultraviolet rays then are started and the quartz rod is drawn out slowly, the emerging rays bathing the whole inside of the nose as this is done. Powerful beams of rays are used, so that it is possible to give the entire inside of the nose a mild sunburn in less than a quarter of an hour.

PLAN NEW TYPE AIRPLANE FOR STRATOSPHERE

A NEW type of airplane, constructed for flights in the stratosphere of an altitude of more than 30,000 feet has been built for the French Government according to plans suggested by Professor Auguste Picaard, the Belgian scientist who recently made a balloon trip in the stratosphere in the interests of science. The plane has many novel features, including tanks which supply air to the hermetically-sealed cabin; a device which maintains the proper fuel supply for the engine and an arrangement which prevents the fuel from freezing at high altitudes.

The sponsors of the Picaard plane predict that it is capable of developing a speed of 465 miles an hour in the stratosphere, making the crossing of the Atlantic Ocean in ten hours a possibility.

CHICAGO TELEPHOTO CENTER

Chicago, on account of its central location, has been selected by the American Telephone and Telegraph Company as a central location for its system of distribution of photographs by telephone. This does not mean that photographs being sent from one section of the country to another are relayed through Chicago, but rather that the management of the system centers in Chicago and photographs being sent from one point to another are still sent directly by merely plugging in the connection at Chicago with the point to be reached. More telephotographs are received in the Chicago office than any other city, although New York City originates the greatest amount of telephoto business in the country.

SOMETHING NEW IN MEDICINE

The recent important discovery at Cornell University of antiurease, the first antienzyme, has opened an important field of medical research, developments in which will be watched with intense interest by the medical profession and the public in general.

Experiments on lower animals have shown that the newly discovered preparation will neutralize the action of enzymes, which are substances secreted by the body. The presence of enzymes in the system serves to maintain the equilibrium which has so direct a bearing upon normal development and, even, existence. Enzymes, for example, set up a balance which limits the size of the heart and other parts of the body to reasonable proportions. Enzymes also aid digestion and, in general, keep the body in action as an evenly developed and well balanced machine.

PROVE OPEN WIRE 'PHONE FASTER THAN CABLE

Experience has shown that voice waves travel much more slowly over wire circuits which are enclosed in cables than they do over those strung along poles in the open. The velocity of a voice wave over cable lines is about 30,000 kilometers per second on long distance lines, as compared to nearly 300,000 kilometers per second on open wire circuits.

One of the results of the slower transmission in cables in an echo effect which, if delayed sufficiently over a long circuit, would result in the speaker hearing an echo of his own voice. This is prevented, or largely eliminated, by a device known as an "echo suppressor," by means of which the transmission of voice waves in one direction interrupts the path over which the echo currents are transmitted in the opposite direction.

MAKE X-RAY SOUND FILM OF SINGER'S THROAT

The Montag Morgen, a Berlin paper, has published a description of interesting experiments that were recently made with X-rays in the recording of sound films. At the State High School for Music, X-ray sound films are being made of singers. These films show the larynx, the vocal cords, and the lungs of a person singing, and, in addition to the actual song, they also reproduce the heart and lung sounds of the singer. This combination of anatomy and music will make it possible to determine what physiological factors are necessary to produce good singing. This possibility, which is due to the initiative of Profes-

(*Continued on page* 38)

NOTES *from the* SUPPLY FIELD

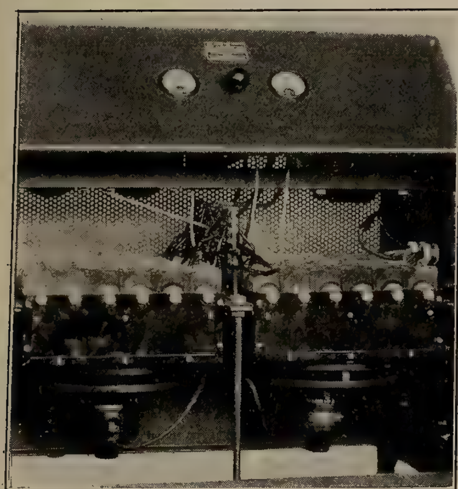
★

COPPER OXIDE RECTIFIER INTRODUCED BY G. E.

THE first copper-oxide rectifier to be introduced for the motion picture field, built to improve the growing use of full-vision screens, wider films and colored motion pictures has been announced by the General Electric Company. The rapid strides made in the motion picture industry have required radical changes in theatre equipment. The so-called "low-intensity" arcs installed in most motion picture theatres are not entirely suitable for the present colored projection and greater screen areas. As a result, a rectifier of high intensity and capable of meeting these requirements was needed.

One of the outstanding features of the new rectifier is that it may be used either for a high-intensity projector or for one or two low-intensity arcs. Used with a high-intensity projector, it supplies 60 to 70 amperes of arc current. Operated with one or two low-intensity arcs, each of the two sections supplies 30 to 35 amperes.

The new rectifier makes use of the copper-oxide disc principal of rectification, which gives it durability, long life and freedom from maintenance expense. A system of forced ventilation, using radiating fins and two small electric blowers, forces a steady stream of cool air over the copper-oxide elements and maintains a temperature within ten degrees of the surrounding air temperature. Not until such a cooling system was perfected was it possible to develop a successful high-output rectifier.



G. E. Copper-Oxide Rectifier

No objectionable noise is made by the rectifier, which enables it to be placed in the projection room. Installation and operation of the unit are simple. One switch starts or stops the rectifier instantly, without the usual "starting" or "warming up" period.

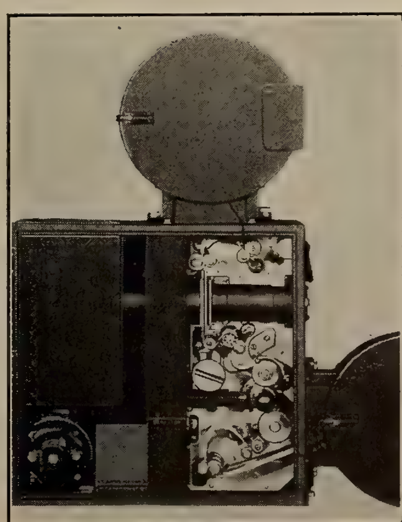
RCA PORTABLE REPRODUCER SETS HIGH STANDARD

RCA Photophone, Inc., announces the production of an entirely new portable sound reproducing unit and has begun its manufacture on a large scale.

The entire unit comprises a projection machine, an ampifier, a loudspeaker and a carry-case for film and these have an aggregate weight of slightly more than 200 pounds. The projection machine is 19″ high, 19″ wide and its breadth is 10". The amplifier, which is built in a carry-case having a removable cover, is 26″ long, 8¾″ high and 11″ in breadth. The loudspeaker, which is of the flat baffle type, is contained in a carry-case, the dimensions of which are 8½ x 19 x 14″.

Standard 35 mm. film is used and adequate sound reproduction is obtainable in a room or hall having a content of 75,000 cubic feet when using the 8-inch directional baffle. A 6-inch dynamic cone speaker is supplied when the cubic content does not exceed 12,000 feet. A picture about 8 x 10 feet in dimensions is obtained upon the screen from a throw of 75 feet. The equipment is AC-operated from an outlet of 105 to 125 volts, either 50- or 60 cycle, single-phase power source. The total power required is approximately 12 amperes at 100 volts.

Connections between the various units are made by means of suitable cables fitted with necessary plugs and receptacles. For a complete set-up using one projector only four cables are required.



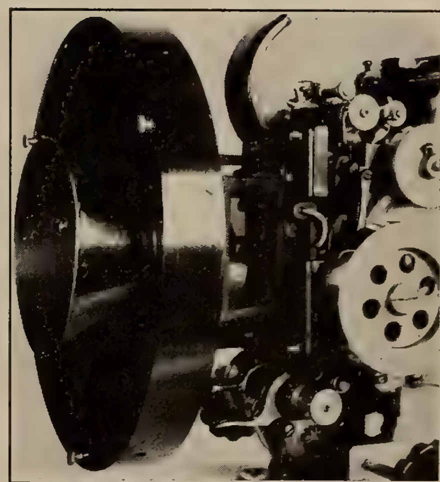
RCA Portable Projector

One is for the power supply to the projection machine; one for the power supply to the amplifier which may be plugged into a receptacle in the projector; one to connect the signal circuit of the projector to the amplifier, and one from the amplifier to the loudspeaker.

The projector is designed to accommodate a one thousand foot standard reel, a Standard Series I theatre projection lens with limits of focal lengths of 3¾″ to 8″; a 1,000-watt, 110-volt, prefocused base projection lamp; a 110-volt, 7½-ampere exciter lamp, and a UX-868 photo-electric cell.

KNOWLES REAR SHUTTER FOR POWERS PROJECTORS

THE Knowles Rear Shutter Company of Los Angeles is now marketing a rear shutter for Powers projectors. This device modernizes the Powers projector to where it is no longer necessary to discard the Powers now in use for a heavier and more expensive make of projector because of the excessive heat generated by the high-intensity arc.



Knowles Rear Shutter

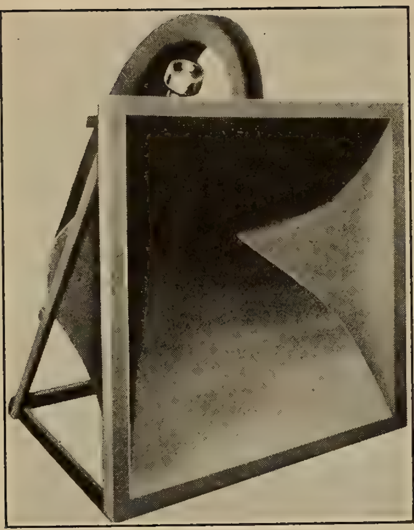
The Knowles Company claims that its device affords nearly 78 per cent cooling at the aperture, an almost complete absence of film buckling, and a light increase of from 20- to 35 per cent at the screen.

A smooth and novel framing device replaces the old jerky form of framing bar that invariably overshot the mark. A quick means of setting the shutter while running is also had with a new type of collapsible glare shield.

This device is built as an integral part of the projector head mechanism and will last as long as the projector itself. It is said to sharpen the focus to a remarkable degree.

MG SETS FOR REPLACING STORAGE BATTERIES

MOTOR-GENERATORS for replacing storage batteries in theatres have been developed by the Electric Specialty Company. These machines supply low voltage D.C. for the fields of loudspeakers and for the exciter lamps



Macy Exponential Horn

of the sound equipment. They are very carefully designed so that they do not cause any objectionabe background hum in the loudspeakers. A simple filter system is used when they supply power to th exciter lamps; but filters are not used with the horn fields. The machines are furnished complete with filters, when required, and they may be readily connected in place of the storage batteries.

These machines are of exceptionally rugged construction and are mechanically designed for the least possible amount of attention and maintenance expense. Wool-packed sleeve bearings, which require no attention except very infrequent lubrication and which run very quietly are used. The machines are semi-enclosed, all live parts and rotating members being completely protected. Terminal boxes are provided for conduit connection.

These motor-generators provide a reliable source of power and, according to Electric Specialty, are more economical in the long run than other forms of power supply appartus.

BURGESS BATTERY CO. HAS NEW LIGHT RELAY

COMPLETE, ready-to-use light relay and light source units of extreme simplicity, ruggedness and reliability, are announced at this time by the Radiovisor Division of the Burgess Battery Co. The units are designed around the novel Burgess Radiovisor Bridge or light-sensitive cell, developed in England and recently made available in this country.

The Burgess light relay units are available in both A.C. and D.C. models for use on usual power supplies. The units are in the form of an aluminum housing with window, containing a circular platform on which the bridge, tubes and other components are mounted. The A.C. unit comprises bridge, two 427-type tubes serving as amplifier and rectifier respectively, power transformer, filter condenser, resistors, by-pass condensers and power relay. The D.C. unit comprises bridge, one 427-type tube serving as amplifier, voltage reducing and other resistors, bypass condenser and power relay. The unit housing is held by a wall bracket ring, permitting of necessary adjustments to line up the window with the actuating light source. When provided with the Burgess Vacuum Contact, the light relay can control a circuit handling up to 1,320 watts.

Requiring no other installation than wall or other mounting, and connecting with the usual electric outlet and the circuit to be controlled, the Burgess units are available for one end of light-control applications.

VOLTAGE CONTROL UNIT FOR SOUND SYSTEMS

IN order to obtain most satisfactory results from sound equipment of the type utilized in theatres it is essential that the input power to the amplifier be maintained constantly at the rated voltage. Although the various power transformers in an amplifier are usually equipped with primary switches so that the unit can be adjusted for any input voltage within certain limits, if there is a tendency for line voltages to fluctuate, a master power control is essential.

A manually-operated line-voltage control unit of convenient size has been announced by the American Transformer Company, This unit was especially designed for the purpose described above, is for use in fifty 60-cycle circuits, and consists of an adjustable auto-transformer with a meter for indicating the voltage supplied to the power circuits of the amplifier. The device will permit of maintaining the voltage at a constant value of 110- or 115 volts, as desired, and may be used where the existing supply is between 90- and 130 volts. Adjustment is accomplished by a special multipoint switch which increases or decreases the potential in 5-volt steps without opening the circuit at any time. It has an electrical rating of 750 va.

The AmerTran power control Type T-750 is housed in a compact sheet metal box designed for wall mounting. It requires a wall space of 6¼" by 11¼" and the overall depth is only 9." The meter employed is a 3" diameter flush-mounted instrument and the control is a large bakelite knob 2¼" in diameter.

AmerTran Voltage Control Unit

G-M CELL COUPLING CABLE

G-M Laboratories, Inc., announces a new cell coupling cable for use in sound equipment. This cable has five times the capacity reactance of standard microphone cable so frequently used in sound equipment, and in addition, is highly non-microphonic.

The use of this cable reduces the attenuation of high frequencies, eliminating to a large degree the frequency discrimination of most photoelectric cell amplifiers. This results in increased brilliance of reproduction of voice and instrumental music, so noticeably lacking in many types of sound equipment.

Those interested in this cable may obtain information by asking for G-M bulletin No. 134.

CHEAP COLOR PHOTOGRAPHY SYSTEM SHOWN IN VIENNA

Vienna papers are exploiting with illustrations the invention of a local expert, Alfred von Bariss, who says he has perfected a camera and a process which makes color photography simple and cheap.

The camera he manipulated recently before a gathering of reporters is described as "an ordinary press camera with a good, but ordinary, lens." By the aid of mirrors the light coming through the lens is diverted evenly on three plates inside the box — a yellow plate at the top, a red plate at the back and a blue plate at the bottom. The operation took three minutes, during which von Bariss said:

"You may use ordinary panchromatic roll film, film packs, or plates. I am using ordinary films."

Simultaneous Exposure

He went on to say that the picture could be taken either by snapshot or by time exposure, but that the three negatives must be exposed simultaneously. He then took the negatives to a dark room and developed them, transferring each to specially prepared gelatine sheets, which, he said, could be had for 5 cents apiece.

Next he produced a little box in which he placed the gelatine sheets on top of each other over a chemically prepared paper and said:

"It is this paper which is my secret, and on which I have worked for seven years. With it you are able to do away with washing and fixing, and can print your colored photographs in ordinary light in three minutes."

He then showed how toning and other artistic effects could be produced on his paper by placing the colored plates at slight angles or in different sequences. He added that any number of colored prints could be made from the colored negatives on his paper, which, he said, cost only a cent a sheet.

16 MM. SOUND FILM

A New York manufacturer promises a demonstration of 16 mm. sound-on-film within the next month. The demonstration will include both recording and reproduction.

The PATENT PAGE

Edited by H. L. Burkitt

THE following digest of patents granted recently was prepared exclusively for INTERNATIONAL PROJECTIONIST by Henry L. Burkitt. Mr. Burkitt, B.S. in ch. e., L.L.B., is a former Assistant Examiner in the U. S. Patent Office, a member of the Bars of New York, Pennsylvania, and the District of Columbia, practicing in New York City. Any reader desiring information on any patent, whether abstracted herein or not, or wishing to secure a copy of any patent listed herein, may secure same by addressing Mr. Burkitt in care of this publication.—*Editor.*

. . . *not "clips" in wordy patent language but clear and concise abstracts prepared especially to meet the needs of readers of this publication.*

Granted August 11, 1931:

Motion Picture Film

1,817,977. *Motion Picture Film to Paul Favour, assigned to Eastman Kodak Company.*

This patent relates to a motion picture film used apparently for the production of a fade-out, and then the return to the same or a different picture. It comprises a film having two consecutive film portions, each carrying images, the images in each area being of substantially uniform density. By means of an additional layer, placed over the junction point of the two consecutive portions and a section of each portion on each side of the junction point, the light may be retarded in varying relation as the film is moved along, the layer being entirely opaque at the junction point.

Composite Photography

1,818,354. *Composite Photographic Method and Apparatus, to Roy J. Pomeroy; assigned in part to Paramount Publix Corporation.*

The patent relates to the production of a composite photograph, that is, the making up of a photograph by exposing two distinct films simultaneously to the same object. In this case, the object is positioned before a non-actinic ground. One of the films is relatively over-exposed, and this film is developed to produce a substantially opaque mask image of the subject. This film is then used to mask the other film during its exposure to a desired background so that the subject image of the second film may be combined with an image of that background.

Motion Picture Machine

1,818,355. *Motion Picture Machine, to William C. Readeker.*

The patent is for the combination with the casing of motion picture apparatus, in which a plurality of the angularly related walls are provided with openings through which pictures or images may be projected of a lens holder, provided for mounting to direct light rays through one of these openings. A deflector is pivotally mounted upon the lens holder and may be moved to intercept the light rays from the lens. The lens holder may be adjusted, with the deflector in intercepting relationship, to deflect the light rays selectively through any one of the other openings. The deflector is provided with means for retaining it in inoperative position on the lens holder so that light may be projected by the lens through the first named opening.

Granted August 18:

Loud Speaker

1,818,987. *Radio Loud Speaker and the Like, to Charles Hugh Duffy.*

This is a loud speaker in which two or more field windings of different electrical impedances are arranged for actuating the diaphragm. The flow of current through one of the windings may be reversed with respect to the direction of flow of current in the other winding.

Disc Reproducer

1,819,083. *Phonograph Reproducer, to William H. Edwards; assigned to American Telephone & Telegraph Company.*

This patent is for means, combined with the needle holder on an electrical phonograph reproducer, for subjecting the disk of the reproducer to bending stresses, under the control of the needle holder, to vary the impedance of the disk.

Loud Speaker Device

1,819,183. *Loud Speaker Device, to Israel Ludlow; assigned in part to Albert E. Lamb.*

This patent is for a loud speaker having the energizing means for the diaphragm active substantially at the center of the diaphragm. One surface of the diaphragm acts on free and unconfined air. A fixed and substantially non-vibrating sound deflector is arranged concentrically with, and spaced away from, the diaphragm and, together with the diaphragm, forms a chamber at least partially enclosing a body of air. An angular passage is formed between the edge of the diaphragm and the deflector so that sound waves may pass out at this point.

Picture Screen

1,819,268. *Picture Screen, to Homer Saunders.*

The screen of this patent is made for use in the showing of sound films, that is, the loud speaker would be positioned behind the screen and sound pass through the screen. The screen is of woven wire having a coating of adhesive on most of the strands and leaving openings between strands. Beads are applied to the screen to cover the adhesive coating substantially. The beads are irregularly attached, leaving openings among the beads, which openings, in many cases,, extend completely through the screen. The beads are defined as being of approximately the same size as the mesh of the screen.

Distortion Eliminator

1,819,327. *Means for the Elimination of Distortion and the Creation of Stereoscopic Effects in Moving Pictures, to Graves Griffith; assigned to Griffith Camera Corporation, Ltd.*

The structure of this patent utilizes a screen having a curved picture area. The projector is mounted on a curved track. The curve of the track and the picture area are arcs of concentric circles.

Geneva Substitute

1,819,593. *Camera, to Royal A. Clapp.*

The invention apparently is directed to a substitute for the Geneva movement, customarily used. In this case, an eccentric actuates a member having teeth to engage openings at the edge of the film for the feeding movement.

New Diaphragm

1,819,659. *Sound Reproducing Diaphragm, to LeRoy W. Stunton; assigned to Brandes Laboratories, Inc.*

The reproducer includes a diaphragm conical in construction and of mechanically stressed thin sheet material having an elliptical periphery. The periphery has a supporting member attached thereto.

Sound Screen

1,819,776. *Cinematograph Screen, to Jacob C. Heck; assigned to Da-Lite Screen Co., Inc.*

This screen is intended for coordinated sound transmission and is comprised solely of a single thickness finely woven textile fabric provided with per-

forations sufficient in number and size to permit the passage of sound waves without blurring, while, at the same time, preserving the light reflecting properties of the screen.

Sound System

1,819,820. *Sound Recording and Reproducing Means, to Earle L. Kent.*

This system apparently relates to film having a sound track. In this case, the varying intensities of light from the sound track are changed into electrical impulses, and the electrical impulses into sound waves. An inductive coupling is provided for associating an alternating current with the electrical connection between the means for converting the light variations to electrical impulses, and the means for changing the electrical impulses to sound waves, for producing a tremelo effect in the sound waves.

Stereoscopic Camera

1,820,113. *Camera, to Gianni Bettini.*

The patented camera is for recording stereoscopic films. Two separate films are used, with two separate lenses. But a single exposing mechanism operates both lenses simultaneously. The sensitized plate is advanced progressively, past the lenses, presenting successive rows of sensitized spaces.

Rewinding Mechanism

1,820,731. *Motion Picture Rewinding Mechanism, to Max Dainow.*

The reel of this patent has a spin extending through an opening so that the reel can be freely turned on the pin. The pin has a stop at its outer end. A crank handle is attached to the reel, offset from the opening, and has an arm with an opening through which the stop is intended to pass when the stop is parallel to the pin. A recess is provided for the reception of the crank handle when inoperative. The arm of the crank handle is between the stop and adjacent face of the reel when the handle is inoperative and when the stop is operative.

Screen Frame

1,820,739. *Motion Picture Screen Frame, to John Thomas Heck; assigned to Da-Lite Screen Company, Inc.*

The patent relates to a collapsible frame for a screen wound upon a spring actuated roller.

Granted September 1:

Slide Device

1,821,341. *Slide Shifting Device, to Austin K. Hanks; assigned to Trans-Lux Daylight Picture Screen.*

This arrangement is for consecutively shifting into position individual slides from a stack.

Fire Preventive

1,821,515 *Device for Protecting Films Against Ignition, to Kurt Hoffmann and Max Engelmann; assigned to Zeiss Ikon Aktiengesellschaft.*

This device incorporates, together with the ordinary fire gate which is operated, in this case, by the loop formed by a broken film band, means for stopping the motor in addition to swinging the fire gate or shield into position. Means are provided allowing for resetting of the parts after such stoppage, and also a protecting plate is arranged to prevent loose ends of the broken film from becoming entangled in the mechanism.

Sound Radiator

1,821,547. *Sound Radiator, to Ralph L. Hartley; assigned to Western Electric Company, Inc.*

This sound radiator has means for tensioning it and to drive it at every point along its edge.

"Delusion Pictures"

1,821,626. *Producing Projection Pictures, to Fritz Fleischer.*

This apparatus is to produce delusion pictures. Moving pictures are directed onto the same screen with the picture from a plate. The same light source, by a reflecting medium, is utilized for projecting the two pictures.

Multicolor Film

1,819,981. *Multicolor Cinematograph Film Material, to John Edward Thornton.*

This relates to a particular type of film for multicolor photography. A mosaic pattern of two longitudinal stripes of different colors, two colors being presented in each stripe, is the structure specified.

THE LOUD SPEAKER

APS

A Technical and Educational Publication. Devoted to the Western Projectionist and his Progressive Fellow Craftsman Everywhere.

W. G. CROWLEY
Editor-in-chief

Editor Finn Congratulated

It is not often that a projectionist has the opportunity of writing an open letter to an editor and be absolutely sure that it will be published. I feel therfore that I am particularly favored as I write this.

There is a man in New York who edits a first class projectionist magazine which has been fittingly named and is devoted to the craft wholeheartedly. This man's name is James Finn. Most of you have heard of him. Whether or not you know him you are invited to read this letter to him. He will read it the same as you. He hasn't the slightest idea that it is coming. So here goes:

Dear Mr. Finn: You certainly made a scoop (as the newspaper fellows call it) when you printed the story about the A. P. S. reorganization movement. It was both timely and effective. I congratulate you and your organization—and your contacts on their perfect co-ordination. Your article did everything necessary to create a national interest in the movement. May I presume for a second to be the mouthpiece of the Western Projectionists and thank you for them? As you know the society has prospered in the West and has grown rapidly under the able guidance of such men as Frank Seavier, Sidney Burton, H. E. Reynolds, Lloyd Litton, Richard Crist, J. T. Moore and Marvin Thoreau These men know how to conduct a society. They have proven that fact beyond all shadow of a doubt. And you may depend upon it, Mr. Finn, that if they are given the opportunity to make their activities national in scope they will make the now congealed wheels of the Society turn as they have never turned before. These fellows are hustlers who have the profession at heart. Their earnestness and sincerity are undeniable. Their ability is proven. Where can a better, more capable group be found to bring the ship of concerted academic effort safely into the port of progress?

You have been fair in representing all sides in projectionists' controversies. So fair, in fact, that I for one believe that fairness with you is not an effort at all, it is just a part of your make up. Every projectionist in the country should know how fortunate they are in having your type of man in your important position.

Sincerely yours,

WALLACE G. CROWLEY.

Reproduction of an open letter to James J. Finn which appeared in a recent issue of "The Loudspeaker" organ of the West Coast A. P. S.

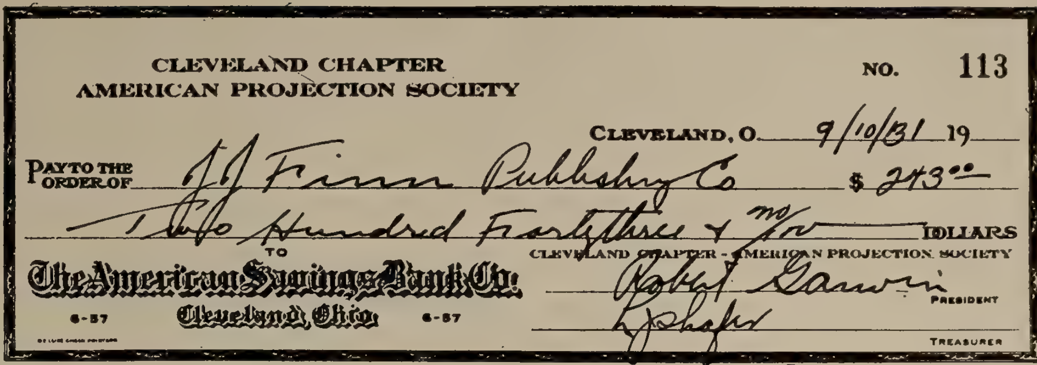
HALF-HOUR PHONOGRAPH DISC

Before such eminent critics as John Philip Sousa and Dr. Leopold Stokowski, a new long-playing phonograph record capable of reproducing an entire symphony has been demonstrated for the first time by the RCA Victor Co. Production of the new record has begun, it was announced, and program transcriptions will last a half hour, using both sides of the disc. The long playing feature is obtained by slowing down the machine's turn-table speed and doubling the number of surface grooves.

The discs are made of a new composition a fifth as heavy as that used in present records. The surface noise from the needle is reduced to less than half that on the ordinary record. Stokowski heard, on the new record, his Philadelphia Orchestra play Beethoven's Fifth Symphony and praised the reproduction.

CHEAP GERMAN RECORDER

The German motion-picture industry has shown great interest in the development of a new sound recorder, according to the American Trade Commissioner in Paris. This system uses Braun valves and requires only one-tenth watt for operation. It is consequently possible to rent or sell such recorders at much lower prices than those of the major electrical concerns. Small producers are particularly interested, as they hope to be able to stay in business if it is possible to record films with a cheap system.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Reproduction of check in payment for one year's subscription for every member of Cleveland Chapter No. 18 of American Projection Society. This check, one of many tendered prior to publication of the first issue, constitutes a splendid personal tribute to James J. Finn and is indicative of the esteem in which he is held by the craft.

INTERNATIONAL PROJECTIONIST

Edited by James J. Finn

TODAY more than ever the projectionist craft needs a *real* organ of expression to champion its cause. The craft today is the beneficiary of an unrestricted amount of advice relating to what it should and should not do emanating from self-appointed oracles who exhibit an amazing arrogance by demanding that the craft extend to them its support and thus insure a continuance of their God-given (?) franchise to *serve* the craft by taking something and giving nothing. This *service* consists of telling the craft what it should do without even touching upon *how* to do it. . . . Enough.

INTERNATIONAL PROJECTIONIST will institute at least one radical innovation in the technical motion picture publishing field in that it will pay for its articles—and pay for them upon acceptance without regard to the date of publication. This statement may be regarded as an open invitation to all those who feel that they have something to say and would like to be recompensed for saying it. Dissertations having their source at company publicity desks will have to be explicit in stating *why* as well as *what;* otherwise they will be deposited in the wastebasket. Products of inferior merit will be exposed as such as readily as will praise be given to meritorious articles. Comment from readers on either editorial content or equipment will be given editorial preference.

Craft news and developments affecting the craft will be accorded ample space. Individual effort of benefit to the craft or reflecting credit on the craft will be publicized; but copy which constitutes merely a personal "puff" will also be deposited in the wastebasket. Local Union social affairs are nice things in themselves, but they make poor editorial copy unless a stray speech or so thereat contains something of value. Organization election results are interesting—at times—but nothing beyond a list of the officers is of much interest—that is, to us.

With the foregoing as a basis on which to work, our editorial policy should produce results and commend itself to our readers.

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Notes from the Science World

(*Continued from page* 32)

sor Schuneman, opens wide and interesting prospects for the future. By means of a single X-ray examination, it will among other things be possible to find out whether or not a human voice is fit for training and, thus, to save money and time to a number of hopeless candidates.

CAT'S EAR AND SPEAKER YIELD NEW HEARING DATA

Evidence that everybody might be enabled to hear about 50 per cent better than normal if a way could be found to press continually on a certain spot inside the ear, has been presented to the American Medical Association by Dr. Walter Hughson and Dr. S. J. Crowe, of Johns Hopkins University, Baltimore. The critical spot is the so-called "round window," a small spot of translucent membrane through which the sound waves leave the three small bones of the middle ear and pass into the coiled, liquid-filled tube of the inner ear where the actual hearing is done.

Dr. Hughson and Dr. Crowe operated on cats under a surgical anesthetic and placed tiny metal electrodes in contact with the nerves leading from the ear to the animals's brain. These electrodes then were connected to an amplifier like those used in radio, so that the nerve impulses generated by the ear machinery could be magnified and measured. It even was possible to send these electric impulses from the nerves over wires to another room and to reproduce them by a loud speaker, so that persons in this distant room heard through the cat's ears whatever would have been heard by that aminal had it been conscious. With this apparatus working, Dr. Hughson and Dr. Crowe then reached into the middle ear of the cat and pressed on the tiny round window so that it was bent inward, increasing the pressure of the liquid in the innermost part of the ear. Hearing always was increased, usually by about 50 per cent.

This happened both with normal cats and with those already partly deaf. Probably continual pressure on the round window would be dangerous to the hearing machinery even if it were possible to maintain it. No hope is held out that increase of inner ear pressure will be a practical cure for deafness. Nevertheless, the discovery that hearing is bettered by pressure, even above what has been called normal, may lead to other discoveries of more practical value.

DR. INNES' SYSTEM OF STEREOSCOPIC MOTION PICTURES

Dr. R. T. A. Innes, former South African Union astromer, has devised a system of stereoscopic film projections by which, he says, it will be possible to see figures and scenes in lifelike relief. The problem has confronted photographers practically since the invention of motion pictures, but hitherto attempts at solution have been based upon the projecting camera itself. Dr. Innes says his invention, for which world-wide patent protection has been obtained, is founded on a special appliance fitted near the screen.

Secret experiments conducted at Johannesburg in the past six months resulted in the adoption of fairly rough models used at the outset, improvised by photographic firms to the needs of commercial exploitation. The final form in which the invention will be exploited is still undetermined. An important feature in the innovation is the fact that changes in the methods of taking pictures will not be necessary.

The Innes discovery was due to an accident. While visiting a café motion picture some time ago he noticed an optical effect on a sheet of glass on one of the walls, giving an extremely lifelike stereoscopic image. He immediately grasped the possibilities and was able to obtain a similar effect by using an ordinary home film projector.

FIRST ORDER FOR FILM

When Thomas Edison heard of George Eastman's success with film, he sent a $3.50 money order to Rochester with a request for fifty feet of film, one inch wide. That order, for the first strip of motion picture film, is still in the files of the Eastman Kodak Company.

SCREENS—THEIR SELECTION AND MAINTENANCE

(Continued from page 29)

spectators sitting close to the screen. The eye can satisfactorily accommodate itself over an angle hardly more than 45 degress, so that the distance of the front row from the screen should be approximately 15 inches for each foot of screen width. For a 15-foot picture, a distance of at least 18½ feet should therefore be provided.

The size of the picture should also be determined by its distance from the rear seats. The width of the screen should be approximately one-sixth the distance from the screen to the rear seats. For a distance of 120 feet, therefore, a 20-foot picture should be provided. Fig. 4 shows curves which may be used in determining the proper size of the picture, and the length of throw should also aid in determining the size of the picture. Here, however, the character of the screen must be considered. If it is of the beaded type, in a house adapted to it, a considerably larger picture can be used because of the increased brightness of the picture as seen from most seats.

It is a fact that the smaller the screen, under a given set of conditions, the brighter it appears. For this reason there is a definite maximum limit to the size of the picture when using Mazda or low-intensity arc lamps of 18 to 28 amperes. Practical tests have determined these sizes to be as shown in Table B.

This table is based on the best figures available at this time regarding screen illumination, which varies from 3 to 7 foot-candles with the shutter in operation, for a picture of average size. For hi-low and high-intensity light sources, there seem to be no limitations beyond the reasonable ones already placed.

It should be remembered that when a given light source at a given distance is used to project on a larger screen, the screen brightness will be lessened, just as a 25-watt lamp in a small room will light a threatre auditorium much less brightly. A 12 by 16-foot screen having an area of 192 square feet is almost twice as bright as a 15 by 20-foot screen having an area of 300 square feet, under the same conditions. Therefore, if a screen is not already more than bright enough, a change to a larger screen should not be considered unless it is to be changed to the beaded type.

Practical showmanship is responsible at times for causing exhibitors to do things that may not be technically correct. The excitement about large pictures (which was accomplished practically, but not satisfactorily, by merely changing the sizes of screen and picture), caused the exhibitors to feel that it is necessary to have a larger screen than is ordinarily desirable. The maximum size of picture, except in unusual cases, should be 18 by 24 feet. If a screen modifier is to be used, there must be sufficient difference between the sizes of the small and large pictures to make the effect worth while. A change from a 20 by 26-foot picture to a 24 by 36-foot picture would not be desirable; however, a change from a 15 by 20-foot standard picture would provide the desired effect.

Position and Surroundings

Local conditions determine to a great extent the location of the screen. In general, it may be said that the illusion of reelism is best maintained by placing the screen either as close to the floor as possible or not more than 18 inches above it.

When possible, the floor of the stage on the house side of the screen should be covered or painted with a dark non-reflecting, non-glossy material, as the stage floor produces annoying reflections of the picture.

The screen should, of course, have a

mask around it to properly frame the picture, and to reduce the "jumping" effect which occurs when poor film or poor equipment is used. This mask is usually a black cloth free from gloss, but at various times a less absorptive material has been advocated to reduce the sharp contrast between the frame and the picture. Because of jumping, it is not desirable to use a light material next to the screen; the desired effect may be accomplished by a graded surface, with the darkest material adjacent the screen.

Sometimes screens are tilted in order to correct for keystoning, or, with silver screens, to redirect the light to better advantage. This is a difficult problem, and furthermore, it might be stated that a tilted screen collects more dirt than an upright screen. Tilting should be restricted to silver screens. Keystoning and side-view distortion are due to large projection angles or poor perspective, and cannot be corrected by using a modified aperture plate. Side-view distortion cannot be corrected but can be avoided to a certain extent by keeping the screen as far from the front seats as possible, and by eliminating the wide front seats.

The principles of correct lighting for theatres are so well known that only a few of them will be mentioned here:

(a) The intensity of illumination should gradually diminish from the street to the auditorium, so that the eyes may gradually become accommodated to the low intensities.

(b) Auditorium lighting should be of low intensity. The auditorium should be only sufficiently bright to permit patrons to readily locate empty seats, and not so bright that they will be distracted by movements of other people. Less light is needed in the front of the auditorium.

(c) All light sources should be diffused so that no points of considerable brightness are apparent, and no lights should be near the line of vision when viewing the picture.

(d) The light should be so deflected that as little as possible falls on the screen.

Installing the Screen

The manner of installing screens has an important bearing on the results obtained with them and the economies effected. A few rules for installing screens will therefore be given. However, when manufacturers' instructions are available, they should be followed to the letter.

(1) Whenever possible, and wherever a screen is smaller than 15 by 20 feet, the screen can best be installed by assembling the frame on the stage or on the seats with the top toward the place the screen is to be.

(a) Lace the left side, which is the top screen surface, on the roll. Follow with the top and bottom of the screen, and then the right-hand side.

(b) When the screen is in place, tighten the laces; in the case of a beaded screen, where there is no need for extreme tightness, do not stretch other than to remove the wrinkles.

(2) If the frame is already in an upright position, a line should be fastened to the shipping roller and the screen should be raised into place on the left side of the frame, rested on the bottom rail, and fastened by the line to the top rail. Care should be taken not to crush the screen or allow the material to sag from the roller.

(a) With small pieces of line, starting at the corner grommet, tie the screen into place at the top grommet, unrolling the screen as each grommet is tied to the frame.

(b) Lace the top of the screen after it is temporarily in position; then lace the bottom, and finally the sides.

(c) When the lacing is finished, tighten it gradually to free it of excess wrinkles. Do not stretch tightly.

Maintaining Screen Surface

There are four phases to the maintenance of screens; one pertains to the preventing of dirt from accumulating on the screen; another to freeing it of excess dirt; the third to a complete and thorough cleaning of the screen; and the fourth to the renewing of the surface. The final objective is to keep the screen surface as nearly perfect as possible at all times by taking all precautions and by systematically attending to it.

The surfaces of sound screens have

very dissimilar characteristics. Some are very rough, some smooth, some hard, and some are sticky. The perforations add much to their ability to collect dirt, and porosity of the surface adds to a somewhat lesser degree. The circulation of air through the openings also makes it easier for the screen to collect dirt. Silver screens collect dirt, just as do the beaded and white screens; furthermore, they become tarnished, resulting in a lowered reflection value. A hard white screen is better than a sticky one from the maintenance standpoint.

Accumulation of Dirt

The amount of dirt deposited on the surfaces of the screen depends on the atmosphere of the house, on the neighborhood, on the circulation of air in the theatre, and on the precautions taken to protect the screen. The first step to be taken toward keeping the surface clean is to determine whence the dirt comes, and to alleviate the difficulty at its source. The following are the more obvious sources of dirt; and remedies:

(1) Dirt falling from overhead and draperies. Thoroughly clean overhead, side draperies, and masking. Prevent travelers from brushing the screen.

(2) Stirring up of dirt by cleaners. Cover the screen at night when not in use, even though with only the cheapest kind of material.

(3) Circulation of air through the screen. Close doors, etc., which cause drafts, and back the screen, close to the horns, with a neutral gray material to prevent air from circulating through the openings.

Even after taking all these precautions, the screen will collect dirt. Inspection will indicate whether the dirt is dry or greasy and, therefore, whether the screen can be brushed. If the dirt is dry, the screen should be brushed with a long-handled special screen brush. It is also well to vacuum-clean the back of the screen once a week. The brush should be kept clean.

Cleaning the Screen

No satisfactory method of cleaning screens has been suggested as yet. It is possible to clean small samples of screen material, but the cleaning of screens installed in the theatre or when returned to the factory is not practicable. The screen sags, and water soaks in at the perforations, causing deterioration of the surface. Streaks result from unequal drying. The soap causes the screen to become yellow after a few days. If screens must be cleaned, however, there are certain instructions which, if followed, will produce better results than are usually obtained:

(1) Great care must be taken;
(2) Use two buckets, one for the cleaning solution and the other for clean water;
(3) Keep the water and solution clean at all times;
(4) Free the surroundings and screen of excess dirt before cleaning; vacuum preferably;
(5) Use soft sponges and keep them dry, so that no water will run down the screen;
(6) Work from the bottom to the top of the screen;
(7) Use plenty of light.

Replacing the surface of diffusing screens by spraying is receiving considerable attention. When carefully done, and when the proper material is used, a satisfactory job may be possible. The material should have a high reflection value, and should become yellow as little as possible. Here again, the screen and its surroundings should first be cleaned thoroughly.

In conclusion, in order to properly select, purchase, install, and maintain a screen, the following outline should be carefully followed:

(1) Decide on the proper type of screen for the house.
 (a) If the projection angle is less than 20 degrees and the house is not extremely wide, use a beaded screen.
 (b) If the projection angle is greater than 20 degrees and the house is extremely wide, use a matte screen.

(2) Choose the best screen surface of this type.
(3) Analyze the house conditions and select the proper size of screen.
(4) Install the screen properly, following the manufacturer's instructions.
(5) Permit no circulation of air through the screen.
(6) Cover the screen when not in use.
(7) Brush the screen regularly once a week, with the proper kind of brush.

Discussion:

PRESIDENT CRABTREE: How are the screens cleaned? If the brush method is used, how are they brushed? Is the screen taken down from its position or is it brushed in place? Also, how is the screen resurfaced? What is the cost of resurfacing in comparison with the cost of the screen Is it worth while?

MR. FALGE: The screen is cleaned in position with a very soft, long-handled brush. Cleaning is very simple, but is often neglected. Some one in every theatre should be given the responsibility of keeping the screen clean. The cost of taking down the screen, packing and shipping it to be resurfaced, and mounting again is so great that it is better to clean the screen in position. Screens may be resurfaced in a number of ways, the spray process being the most satisfactory. The cost of this treatment varies in different places, from 10 to 20 cents per foot. A new screen may cost from 2½ to 4 times the cost of resurfacing, depending upon the amount of surface to be treated. Screens can be resurfaced satisfactorily, but in general, the process is not satisfactory, as the material used for resurfacing becomes yellow and is not always put on uniformly.

PRESIDENT CRABTREE: What is the effect of spraying a beaded screen? Is it cleaned by spraying, or were you referring to diffuse screens?

MR. FALGE: I was referring to diffuse screens. No good is accomplished by spraying a beaded screen, as the spraying causes the beads to lose their directive qualities. In general, it is extremely difficult to properly clean screens on account of the wide expanse of the flat surfaces. Beaded screens can be cleaned satisfactorily, but the process is very complicated.

PRESIDENT CRABTREE: Could some solvent be used for cleaning the beaded screen?

MR. FALGE: To a certain extent; but the solvents that have been tried have loosened the adhesion of the beads and so such methods have not been found satisfactory up to the present.

PRESIDENT CRABTREE: The matter of standardizing screen sizes is very important. Has this matter been brought to the attention of the Projection Screens Committee?

MR. FALGE: Yes, but nothing definite has been done about it as yet.

MR. SCHLANGER: The information given in this paper referring to the proper distance between the seats and the screen is very important and should be referred to the American Institute of Architects. In relation to the shape of the screen, I suggest that perhaps Mr. Dieterich might say something about the restful physiological effect of the 3 to 5 ratio on the human eye.

MR. DIETERICH: Yesterday I briefly mentioned the fact that there is a minimum distance required between the eyes and the screen for comfortable viewing the picture. To go a little deeper into the discussion we must consider the sight characteristics of the eyes, which when plotted, assume a peculiar egg-shaped form for each eye. The combination of the two characteristics produces a more or less heart-shaped curve for the combined characteristics of the two eyes—*i. e.*, for binocular vision. If we inscribe a rectangle into the combined characteristics we are led to the classical ratio of height to width of 1 to 1.6. As long as we have to change the proportions of the visible picture—which we must do sooner or later—we should consider the esthetic demands, because they control to a great extent the reaction of the public, which again influences box-office returns. As long as it is necessary to change the dimensions, I am endeavoring to advocate that we should change in accordance with this ratio. There will be a number of technical difficulties, and problems to overcome, but they will have to be overcome sooner or later, in any event. The Standards Committee has suggested a 50-mm. width for production reasons, but we can just as well use the proper proportions for this width as for any other. Mr. Schlanger suggested that when one sits in front of a screen that is 40 feet wide, he may come closer than 40 feet. However, this would not place the screen within the "easy" range of the eye. The eye must exert an effort to encompass an angle greater than 60 degrees and although our total vision is limited only by about 180 degrees, it becomes a painful effort to use it to its full extent. Along the horizontal axis of vision, the "easy" range is normally 30 degrees on each side, and along the vertical axis about 10 degrees above and 20 degrees below the horizontal. If the scheme of Mr. Schlanger is in accordance with these physiological facts, he will find that the spectator will enjoy the picture more than in the past. As to the question of depth perception, the recognition of depth in the wide picture is due to the fact that when one looks at a wide screen, the distances to the edges of the picture are perceptibly greater than the distance to the center, and the eye has to accommodate itself to such different focal values. Therefore, the only means of perception, which is by the final nerve center, would cause a reaction, resulting in a muscular effort to accommodate the eye. Therefore, the wide picture has certain disagreeable effects for the present front seats, but which lessen as the distance from the screen increases. The minimum distance between the screen and the front seats, should not be less than the width of the picture.

MR. FALGE: The ratio you suggested is close to the 3 to 5 ratio which I mentioned previously.

MR. JONES: There was one statement in Mr. Falge's paper I should like to question. In discussing the diffusing type of screen he stated that the brilliance of the screen depends upon the viewing distance. I cannot see why the argument applies to the diffuse type of screen and not to the beaded type. It is quite possible that the brilliance of the screen—that is, the apparent brightness—is to a certain extent influenced by the angle of the screen and by the surroundings. I think it is quite possible—and I know it is true—that whether the screen appears to be more brilliant at one distance than at another will depend upon the surroundings of the screen. I think we should recognize that that characteristic, which may be a true phenomenon, is a characteristic of all types of screens, and I cannot see that it is a characteristic of a diffuse type of screen any more than of any other.

MR. FALGE: What I meant to convey was that this effect is more pronounced in the case of the beaded screen. I referred to it briefly in connection with the beaded screen. As far as the surroundings are concerned, if too much light is present, the pupils of the eyes become smaller and the screen does not appear as brilliant as one would like it to be.

MR. OTIS: Have any measurements been made on the diffusiveness of the screens to color?

MR. FALGE: Do you refer to a particular one of the three types, or to all screens? I do not believe that such measurements have been made.

MR. SCHLANGER: Referring to the shape of the picture and the desirability of retaining the 3 to 5 ratio, it is possible to change the shape of the screen throughout a picture so as to present different geometrical forms—triangular, rectangular, circular, etc. I understand that some work has already been done along that line.

MR. DIETERICH: Madame Ducat, the only female member of the Legion of Honor, has invented a new "panel" aperture. Her idea is that everyone who has a sense of the artistic frames a picture or composition according to the composition, and does not take the frame and fill it with the composition. The frame should be under the control of the cameraman so that he may instantaneously alter the picture frame as desired. This does not depart from the 1 to 1.6 ratio for the shape because this ratio is an esthetically fundamental one from which any number of frame sizes can be developed. Her idea of changing the frame size according to the action has been successfully used because she understands the correct use of the panel frame.

International PROJECTIONIST

Edited by James J. Finn

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MONTHLY CHAT

ITS technical excellence assured from the very start, Intertaional Projectionist, looks for new worlds to conquer. And finds them. The typographical beauty of our first issue, which induced so many fine compliments (for which we thank you one and all), has set our contemporaries to hustling. One new cover has already appeared; and we hear rumblings of still another new cover, with an accompanying slight reduction in overall size. This last move is one near and dear to our own heart (don't mention it).

This service by us in the cause of ART is performed with cheerful mien; but we can't withhold the observation that a mere new cover or a change in overall size will fail miserably in matching the high editorial standard we have set.

GREAT chunks of publicity were spread over the landscape of this fair country by the recent demonstration of television at the Broadway Theatre in New York. Most of this publicity was along conventional lines: "television arrived" and all that sort of bunk. Nothing to worry about, gentlemen. Absolutely nothing.

HARDLY a week passes now but what a new indication is had of the increasing interest of the industry as a whole in the quality of the image on the screen. Sound production and reproduction has had more than its share of attention, to the obvious neglect of picture projection. Who is there who will say that the picture in the average theatre today is anything but terrible? No one. Pictures that appear on theatre screens these days would have been laughed at in, say, 1925.

Now, however, the "big boys" are waking up to the serious consequences of a poorly projected picture. Plans are afoot to improve the screen image. Who knows? the "big boys" might even buy a few dollars worth of equipment. Anyhow, they are once more aware of the existence of a projection room in the theatre.

THE ever alert Academy of M.P. Arts & Sciences is sponsoring new aperture standards for cameras and projectors, complete details of which are printed in this issue. The proposed new projector aperture is .615 x .820, which size appears to us to be very close to the safety mark. Whatever standard is finally adopted, projection will benefit greatly, and Portland, Maine, and San Francisco will once more be in agreement as to picture size. Score another for the Academy.

ANNOUNCEMENT . . .

INTERNATIONAL PROJECTIONIST takes great pleasure in announcing the addition to its staff as Advertising Manager of

MR. JAMES BEECROFT

for the past seventeen years advertising manager of *Exhibitors' Herald*. Intimate contact over a long period of years with manufacturers and distributors of motion picture equipment has given Mr. Beecroft a keen insight into their problems and eminently qualifies him to render the utmost service to advertisers in this field.

Manufacturers and distributors of equipment are cordially invited to avail themselves of Mr. Beecroft's vast fund of information relative to the merchandising of their products.

Reader interest engendered by editorial excellence, no less than reader *loyalty* gained by editorial policy, makes the ideal advertising medium. That INTERNATIONAL PROJECTIONIST recognizes this fact is demonstrated by the announcement of the following list of writers who will contribute material to its columns on an *exclusive* basis:

R. H. McCULLOUGH

Supervisor of Projecion & Electrical Equipment, Fox West Coast Theatres

whose articles on projection theory and practice, based on his extensive and continuing experience as head of the technical department of one of America's largest theatre chains, are recognized as authoritative by projectionists everywhere.

SAMUEL WEIN

for the past twenty-five years an active research worker and authority in the electro-technical field.

A. C. SCHROEDER

prominent West Coast projectionist who combines theory with practice in a style readily understandable by the projectionist.

SIEGFRIED S. MEYERS

whose writings on the fundamentals of the sciences underlying the projection art have received the enthusiastic praise of projectionists.

M. ROBACH

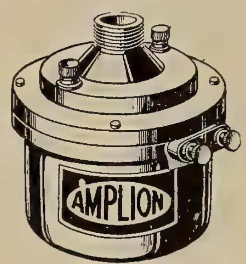
authority in the field of color photography and reproduction who will analyze the developments in this highly important field.

H. L. BURKITT

B.S. in chemical engineering, L.L.B., and a former Assistant Examiner in the U. S. Patent Office, who will edit a patent department and contribute analyses of significant patent developments.

These and many others will speak in this forum. Occasionally we shall make room for one of those gentlemen who make a business of dealing in such terms as *phi, beta, gamma, sigma, delta* and the like, but not unless they explain themselves clearly. News and views of craft developments will continue, of course, to form an important part of our editorial content.

AMPLION OCTOPHASE SPEAKERS



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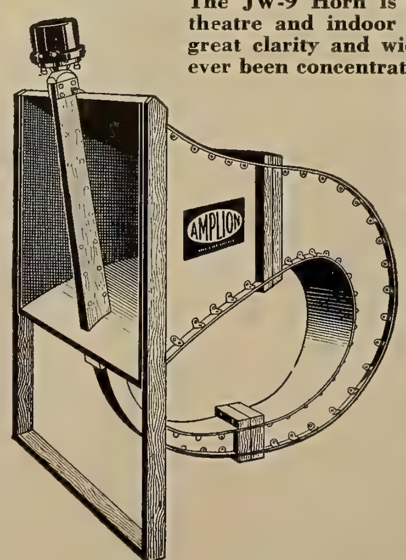

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INTERNATIONAL PROJECTIONIST

VOLUME I NUMBER 2

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SOUND PROJECTION: THEORY AND PRACTICE

R. H. McCullough

DIRECTOR OF PROJECTION, FOX WEST COAST THEATRES

THE projectionist of today must meet the demand for improved quality in sound reproduction. This achievement is accomplished only by periodic tests at regular intervals of vacuum tubes, amplifiers, horns, generators, batteries, circuits and associated equipment. It is imperative that the output of sound projectors be matched so that the same fader setting for each projector will produce the same amount of volume output—otherwise, the difference in the output of the sound projectors will be quite perceptible to the audience. Notwithstanding the fact that the sound projectors were carefully matched for the same output volume when first installed, they still require frequent testing as conditions may cause the volume output to drop on either projector at any time. It is true that the output volume of each projector may be the same—however, the output may include distortion.

Matching Volume Output

When balancing sound projectors it is important that the projector R. P. M. speed be checked first. Both projectors should be run for a while before a balancing test is made. If the projector speed is above 90 R. P. M., the higher frequencies will be accentuated. If the speed is less than 90 R. P. M. the lower frequencies will be accentuated. Therefore, the prime requisites, when balancing sound projectors for disc and film reproduction, are *speed*, *quality* and *volume*.

Many projectionists rely upon the output of volume from the monitor horn to ascertain if both projectors are giving the same volume output. This may be considered as the "rough ear" test and will indicate within a few fader steps the matched output volume. However, this is not considered as a favorable method for first-class results.

Before a check is made on sound projectors for the matching of volume output, it is necessary to inspect each exciting lamp. Their filaments should be in good condition. The glass walls of the lamp in front of the lens assembly should be free from discoloration and the entire lamp should be perfectly clean. The current for each exciting lamp should be precisely the same. Occasionally verify the ammeter reading of each exciting lamp. It will be found sometimes that ammeter values differ. Both exciting lamps should be properly focused.

Be positively sure that the Movietone lens assembly and aperture are perfectly clean, as oil on the lens of this assembly will reduce the higher frequency response. The light gate or pressure pad tension should have the correct amount of tension against the Movietone aperture. The photo electric cells should be in good condition. I have found on many occasions that oil and dirt will collect on the window of the photo electric cell, thus preventing certain light variations from being collected which will naturally reduce the volume materially.

Batteries supplying potential to the photo electric cells and the plate supply for the photo electric cell pick-up amplifiers should not differ in voltage more than two volts. It is necessary that the filament current for each pick-up amplifier be precisely the same and that each vacuum tube give the same amount of emission. The pick-up amplifier grid leak connections should be inspected. One of the greatest troubles with grid leaks is the uncertainty and the unreliability of their *resistance rating*. It is imperative that grid leaks be measured for their resistance value with a meter. This can be done by your service engineer

All rheostats and film-disc change-over switches should be clean and noiseless in operation, except for the usual clean "plop" as they pass from one contact to another. Many projectionists rely on the hiss from the photo electric cells for matching the output of sound projectors. If the projectionist is familiar with the results obtained from each photo electric cell, this may be considered as a fair test. When using this method, if the hiss is louder from one than from the other, further tests should be carried out so as to ascertain what is causing the difference in output.

Some sound equipment manufacturers equip their faders with a rapid change-over key. It will be found very useful to use this key instead of the main knob which takes appreciable time to swing from one side to the other when making the balancing test. The best and the most accurate method for checking the balancing of sound-film projectors is to have two test films. Each projector is threaded at the same starting mark and

started at the same time, thus checking the volume of sound first on one and then on the other.

Using Test Reels

It is unnecessary to have two reels of film to accomplish this purpose. All that is necessary is to have two endless loops both with the same recording, thus threaded in each projector so as to give continuous operation. The correct method of making a volume balance test between two sound projectors with film and disc is to have four copies of the same subject; two on film and two on disc. The projectors are then threaded and started simultaneously with both disc reproducers in position; then, whichever way the fader is thrown and whichever way the transfer switch is pushed, the same sound should come from the stage horns.

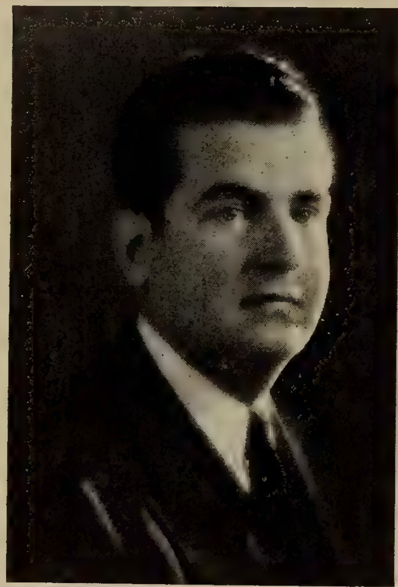
A second projectionist or service engineer usually assists in making this test. This observer usually signals the projectionist in the projection room when to change the fader from one projector to the other. Usually the projectionist removes the observation port glass adjacent to the master fader and inclines his head through this port, listens, and waits for the signal from the observer in the auditorium for switching the fader key or the fader arm from the left to the right projector, or *vice versa*. A person with an experienced ear can always detect any difference in volume, or in frequency response.

It is important that the speed of each sound projector be maintained at 90 revolutions per minute. I have found that a very useful method for ascertaining if both projectors are running the same speed is to place an identical mark on each turntable and, having marks in similar positions, start both projectors simultaneously. If both projectors maintain the same speed, these marks should stay together in R. P. M. If they do not, one will creep ahead of the other, thus indicating that one projector is traveling faster than the other. The degree of similarity required in speed of sound projectors is extraordinarily high. When running two projectors simultaneously in testing for R. P. M., be positively sure that both projectors are running under the same conditions—that is, with or without films. I would suggest that this test be made while film is being run through each projector.

Crackling Noises

Crackling noises may be caused by the following, which are most common with film and disc reproductions:

Dirty fader contacts
Dirty gain control
Dirty potentiometers



R. H. McCULLOUGH
whose articles will appear exclusively in INTERNATIONAL PROJECTIONIST

Dirty rheostat in filament circuit of speech amplifier
Fuse making poor contact
Loose connection
Dirty switch contacts
Dirty variable resistance in horn receiver control cabinet
Poor connection at receiver unit
Poor connection between vacuum tube prongs and socket contacts
Defective fuses

Any piece of equipment, such as the fader, the gain control or potentiometer, rheostats or variable resistances and switches, require constant attention. They should be inspected and cleaned at regular intervals. These equipment troubles are inherent in all types of sound reproducing equipments. A dirty fader is the most common cause of all the aforementioned, which cause crackling noises. When fader contacts first become dirty, noise is first perceptible when moving the fader arm from one side of the fader to the other during the reproduction. Dirty fader contacts should be cleaned with tetrachloride: apply a very small amount of vaseline and polish contacts with a good grade of embossed paper.

The first symptom of a dirty potentiometer or rheostat is a scratchy sound when the slider is rotated over the resistance wire. A dirty potentiometer or rheostat should be cleaned with tetrachloride and the movable contacts lubricated by rubbing a soft lead pencil over the wire and turning the knob in order to distribute the lead evenly. I recommend this as a lubricant because the lead in an ordinary pencil contains a certain amount of graphite which is a very good lubricant. I have found dirty fuse contacts, on many occasions, which were responsible for crackling noises. This condition can be remedied by cleaning the fuse clips with fine sandpaper and then resetting fuse clips to give a tighter grip.

Dirty switches are another common cause for crackling and popping noises. Switch contacts should be cleaned with tetrachloride and lubricated by applying a little vasaline. If the switch contacts are burned from arcing, it may be necessary to clean the contacts with very fine sandpaper. Small key switches require inspection at regular intervals. The small spring blades sometimes become bent and make a faulty contact. The contact points and blades of key switches should be cleaned with a small burnisher.

Vacuum Tube Care

When the vacuum tube prongs and the socket contacts have a film of corrosion over them, the grid and plate circuits are very likely to be affected, but the filament connections usually do not suffer from slight corrosion at these points as much as the grid and plate circuits. Dirt and corrosion on vacuum tube prongs can easily be cleaned off by means of a small nail file. The socket contacts should be given a similar treatment by holding a strip of very fine emery cloth over the ends of a spudger or any small flat stick, which permits one to clean the socket contacts without any trouble.

Vacuum tube prongs and socket contacts should be cleaned frequently, to prevent corrosion. Vacuum tube prongs may be cleaned with a small typist's eraser. This type of an eraser consists of a small revolving piece of rubber erasing material at one end and a small brush at the other end. After cleaning the vacuum tube prongs with this type of an eraser the abrasions may be brushed away, thus assuring a perfectly clean contact.

ELEMENTS OF THE EYE

There are two parts in the perceptive elements of our eyes that function somewhat differently. The part concerned with direct vision is almost microscopic in size and is made up of minute terminal filaments something like cones. With these we get the details of the objects at which we look. It is this minute area that we use in reading or in getting the clearly defined outline of a distant object. If this is destroyed all accuracy of sight is lost. It does not function continuously. It perceives quickly but the impression fades with equal rapidity so that we actually see in a series of rapid flashes with intervals of about one-tenth of a second.

The surrounding field of vision is that which perceives objects at which we are not directly looking, but which are at one or the other side of us.

HALATION: ITS CAUSE, EFFECT AND THE REMEDY

H. Parker and J. I. Crabtree

RESEARCH LABORATORIES, EASTMAN KODAK COMPANY

THERE has been considerable discussion recently on the subject of halation and methods for its prevention. Halation is the blur or halo of light which is sometimes seen in photographs around the edges of bright highlights, and although it may be present throughout the area of the highlight, where it has a deleterious effect on the quality, it is usually noticed only when the blur of light extends into the dark area surrounding a highlight.

In most cases halation is undesirable because it tends to destroy detail, and this is particularly true in the case of the motion picture because of the high degree of magnification on the screen.

In order to attempt to eliminate or reduce this spreading of light around the highlights, it is necessary first to understand the cause.

Cause of Halation

When a ray of light falls on the photographic emulsion, it does not pass straight through, but is scattered in all directions by the silver bromide grains which it encounters in the sensitive layer. This scattering, which causes a spreading of the edges of the ray, is called "irradiation," and results in a slight but perceptible blurring around the edges of the image. When these scattered rays reach the back of the emulsion and pass into the film support, they are travelling in all directions, and so strike the rear surface of the support at all angles. Most of these rays pass on out into the air, but some strike the rear surface at such an angle that, because of the difference in the refractive indexes of the support and the air, they cannot escape but are totally reflected back into the emulsion, thus causing a ring of light around the image. This ring of light reflected from the base is the true cause of halation.

The diagram of a cross-section of film shown in Figure 1, with a narrow incident ray and its scattered and reflected rays, illustrates the manner of formation of both these effects, the irradiation and the halation proper.

Means For Solution

It can be seen readily that the nature and severity of the halation will depend to a large degree on the physical characteristics of the negative material, because the transparency of the emulsion determines the fraction of the light transmitted and the degree of scattering; while the tendency for reflection at the rear surface of the support will determine the quantity of light reflected and the thickness of the support will determine the size of the ring.

Many means have been devised for reducing halation, either by increasing the effective opacity of the emulsion layer so that less light could reach the support, or by reducing the tendency for reflection from the rear surface.

Light absorbing dyes have been incorporated in the emulsion itself, or in a substratum over which the emulsion is coated, but this often involves an unnecessarily prolonged period of washing in order to remove the dye for printing. It was found, however, that excellent results were obtained by coating the fast negative over a slow opaque emulsion, such as a lantern slide emulsion. This acted in two ways to reduce the halation: first, because the bottom emulsion being quite opaque, only a small proportion of the light could pass through, and, secondly, since it was relatively insensitive, the light which did get through to be reflected produced very little effect.

Many means have been tried to reduce the reflection from the rear surface of photographic glass plates. If some material having a refractive index equal to that of glass is coated on the back of the plate, the reflecting surface is moved to the rear surface of the coating. If then, the coating is colored with a dye or a pigment, such as lamp black, all the light is absorbed before it can be reflected, and halation is eliminated.

Many backing materials, colored in various ways, have been used with more or less success. Some of the backings were

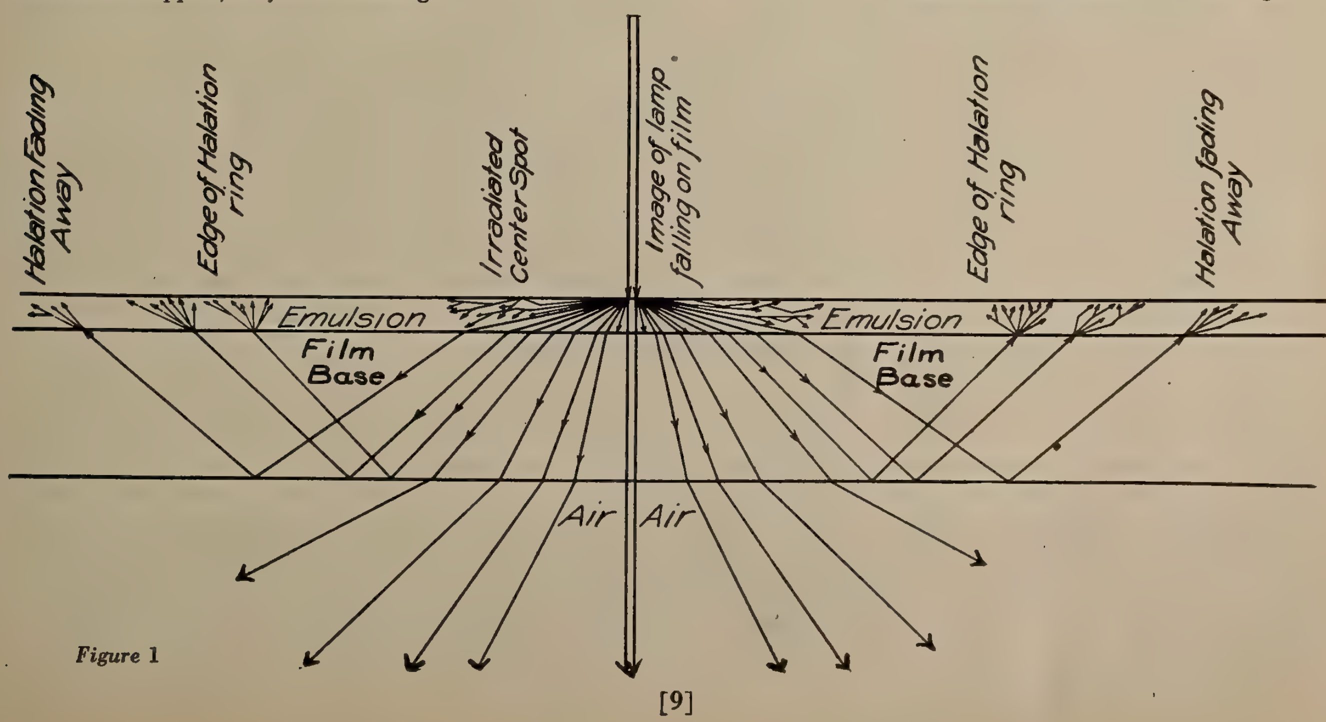
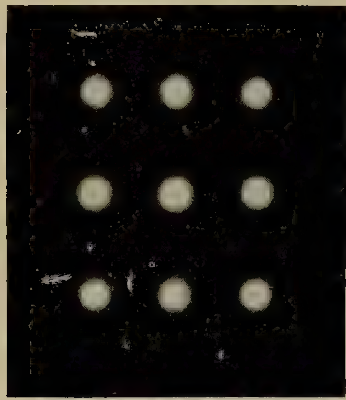


Figure 1

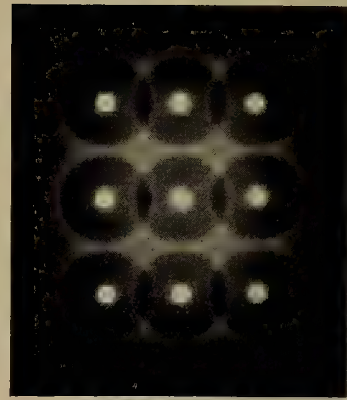
Gray Base Film

FIGURE 2



Clear Base Film

Prints which show clearly the effect of a gray base in reducing halation



Glass Plate

soluble and washed off in the developer; others contained dyes that were bleached in the developer; while others had to be removed in a separate operation after the plate had been processed. Some of these backings were quite satisfactory for practical use with plates, and came into extensive use in combination with the double-coated emulsions.

A great step toward the reduction of halation was made when a thin nitrocellulose film was substituted for the glass plate as a support for the emulsion. Because of the thinness of the film, the halation rings were so reduced in size that they appeared more as a spreading of the blur due to irradiation than as separate rings.

Double-Coated Emulsions

The use of double-coated emulsions on a film support practically solved the problem of halation with the non-color sensitive emulsions, but this was not quite sufficient with the improved color sensitive materials which have come into use lately. The reason for this is simple. The silver bromide emulsions absorb most of the blue light, but they pass a considerable portion of the yellow and red light.

With the non-color sensitive emulsions, this did not matter, because the reflected red and yellow light had little effect on the film. But in the case of the modern panchomatic emulsions, these unabsorbed rays do tend to cause halation.

With plates, cut film, or roll film, the dyed backings which are bleached or otherwise removed during processing can be used very satisfactorily, but such removable types of backing are not well adapted for use with motion picture film, because of the danger of offsetting during its passage through the camera, and possible contamination of the developer. With a permanent backing, however, which remains unchanged throughout the processing and handling of the negative there is no danger of chemical troubles in the developer, and if the density, or light absorbing power is properly adjusted, it will give very substantial protection against halation without being too dense for printing. Although backings of this type have been proposed from time to time, it is only recently, with the introduction of the "Grayback" supersensitive type of negative films, that they have been widely available to and used by the trade.

Gray Base Film

The Eastman Gray Base Supersensitive Panochromatic Negative film is an example of this type. In this film, a neutral gray dye is incorporated in the film support in such a concentration that it absorbs approximately 37 per cent. of the incident light. This does not cause any trouble in printing, but merely requires an increase of one or two steps in the printer exposure. The light which causes halation, on the other hand, must travel diagonally through the film twice, as shown in Figure 1. In comparison with unbacked film, therefore, less than 37 per cent. of 67 per cent. (or under 23 per cent.), of the light producing halation is reflected back into the film.

In order to illustrate this effect, the pictures reproduced in Figure 2 were made. The object was a black mask having a series of holes illuminated from the rear. The right-hand picture was made on a plate, and shows the halation rings previously mentioned. The other two pictures were made on supersensitive panchromatic negative films having the same emulsion, but coated in one case on a clear base and in the other on a gray base. The exposures were equal and the negatives were processed together, receiving identical treatments. The prints show very distinctly the effect of the gray base in reducing the spreading of light around the edges of the image.

The two prints reproduced in Figure 3 show how this affects an actual picture. Although it is difficult to reproduce slight differences in quality or detail in the half-tone cut, the illustrations show that a reduction in the halation not only gives cleaner and sharper definition around the highlights, but also apparently increases the contrast in the neighborhood of the highlights.

FIGURE 3

Clear Base

Gray Base

COLOR IN MOTION PICTURES

An authentic and impartial analysis of the various processes designed to impart color to motion picture film

M. Robach

FEW know the meaning of the terms "additive" and "subtractive" as used in color photography. In the additive methods generally, the positive print is colorless, the colors being produced optically and thus shown on the screen. In the subtractive methods, the colors, without exception, are in the positive itself, and the finished product is ready for projection without any alteration of either the projector or its optical system.

Among those companies or processes mentioned in this article there are only three which have been active within the past year or so. These are Technicolor, Kodacolor, and Multicolor. Sennett-Color is made entirely by Multicolor. The great majority of color processes have remained in the experimental or stock-selling stage, and there is no present indication that even a few will advance much beyond this stage.

At the present moment there is not a single color process that has even the remotest chance of displacing black-and-white pictures in the manner that sound pictures displaced the silent film. Despite this, many enterprising persons are successfully floating many large stock issues in color companies—just by way of proving the truth of Barnum's famous remark.

1. *Two-Color Subtractive Positives*

This is an admixture of orange-red and blue-green photographic images in micro-register which appear in the same frame of the positive, with clear white highlights or a uniform overcast of lemon-yellow tint. The negatives from which these prints are made are known as 2-color separation negatives and consume exactly twice as much raw stock, foot for foot, as black-and-white, irrespective of whether these negatives are produced on a single film strip or on two separate film strips; whether successively alternating or simultaneously; whether by beam-splitting prisms behind or in front of the lens or lenses; or on bi-pack (which will be discussed later).

The color values, or "separations," are photographed onto the negative by interposing a color filter in the light beam during exposure—that is, for the "red series," an *orange* gelatine (No. 22-E, Wratten), and for the "green series," an *emerald* gelatine (No. 60-P, Wratten).

When developed, the negatives appear on casual inspection to be no different than ordinary negatives. On closer examination, however, the differences between the red-filtered and the green-filtered series is easily distinguished, for wherever in the original scene were different colors, these appear in the two series in differing densities. But where there was black, neutral grey, or white in the original scene, these appear exactly alike on both negatives or series of negatives. These "color values" in the negatives are transmitted to the positive in the course of printing and processing, and the original colors of the scenes are recreated. At least, that is the intention of the process.

The lists of names which appear throughout this article refer to the person, company, or trade name which is identified with each particular process. Those using or manufacturing 2-color subtractive positives as part of their processes are:

Brewster—Colorcraft—Colorfilm—Colortone—Harriscolor—Ives—Jones—Kelley Du Chrome—Kodachrome (Foxcolor)—Magnacolor—Multicolor—Pathe Coloratura—Photocolor—Sennett-Color—Technicolor—Wolff-Heide.

2. *Two-Color Subtractive Positives on Dupli-Tized Stock*

This is a sub-division of the foregoing. The two complementary red and green images are producer on obverse and reverse surfaces of the dupli-tized positive stock, which is commonly but erroneously termed "double-coated stock." This stock costs three cents a foot; while ordinary stock costs but one cent a foot. Splicing this stock is a laborious and time-consuming operation, for which reason exchange inspectors are not overly fond of the work. A splicer to properly handle this type of film has never been marketed.

Those using dupli-tized positive stock are:

Brewster—Colorcraft—Colorfilm—Harriscolor—Jones—Kodachrome—Magnacolor—Multicolor—Pathe Coloratura—Photocolor — Sennett-Color — Kelly Du Chrome.

3. *Two-Color Subtractive Positives on Single-Coated Stock*

The use of ordinary stock in this process permits a saving of twenty dollars on a 1,000-foot reel, to say nothing of avoiding the splicing difficulty. This saving, however, may be nullified in production and by waste of time.

The first color-in-the-film positives were made on regular positive stock, following closely the departure of Kinemacolor. By applying a second coating of emulsion to the surface of a blue-toned positive (which was first printed from the red (or orange) negative series), and exposing this second emulsion layer under the green filter negatives; then developing it and finally toning to an orange-sepia (uranium), a 2-color positive was produced, the quality of which was vastly inferior to Kinemacolor. This condition obtains in all present-day subtractive color positives, no matter how good they may be.

If a neutral "grey key" image were to be included with the 2-color image, this lack of quality could be largely but not entirely overcome. We must certainly dub this system a 2½-color process; and it might possibly stave off the day when the dear public will want a 3-color process on wide film, with a quadruplex sound track to boot.

Those producing single-coated color films are: Colortone—Ives—Technicolor—Wolff-Heide.

4. *Bi-Pack Negatives*

A tri-pack negative consists of three separate and different color-sensitive films which are exposed simultaneously in contact, under pressure, in the camera. A bi-pack negative, or pair of negatives, is therefore only two films. This system is enjoying quite some favor at present, as the appended list shows. At least, it avoids the necessity for complicated and expensive color cameras, the regular Bell & Howell camera, with special double magazines and a slight readjustment in the gate and focusing de-

[1] NOTE.—This injunction is no reflection on our contemporaries but is a safeguard against the utilization of any statement herein by unscrupulous stock promoters.

vice, being all that is required. This is exclusive of the special negative stock used.

A brief description of this process would state that an ortho (green sensitive), and panchromatic film is run through the camera gate at the same time, *face to face,* and at the moment of exposure they are pressed into contact, and thus a pair of pictures of equal size is obtained, one on each film. The ortho film has a surface coating of insoluble orange dye (matching Wratten No. 23-A).

Now, during the exposure, the ortho film records the blue and the green colored areas of the scene (along with many other things), and the reds and the oranges are omitted, this film being insensitive to these colors. The red and the orange elements of the scene pass through the emulsion and then through the orange filter coating, which *does not* pass the blue and the green rays, and thus onto the panchromatic film, which records everything *except* the blues and the greens.

The "front" (ortho), film will now contain values representing the blues and the greens, in addition to the regular black-and-white picture structure; and the "rear" (panchromatic), film would contain the complementary values, i.e., orange and red, together with the black-and-white picture. Incidentally, yellow is recorded on both films equally and is reproduced as white. The developing time can be so adjusted that both negatives have practically the same contrast, which is a most desirable condition in color negatives. This is not so easily obtained in single strip negatives.

Those using bi-pack are:

Colorcraft—Colorfilm—Ives—Kelley-Du-Chrome — Magnachrome — Pathe Coloratura—Sennett - Color—Magnacolor—Multicolor.

5. *Single Strip Two-Color Negatives*

Kinemacolor was the first to utilize this method, the images being exposed in uniform succession. The frequency was 32 per second, or so it was claimed, and upon projection this rate was increased to 40 per second. If the rate had not been increased, the flicker would have rendered the process valueless. Where there was fast action, the outlines of the moving object displayed upon projection "fringes" of pure prismatic color.

A later refinement (probably originated by Claude H. Friese-Green), was to expose in unequal succession, in hop-skip-and-jump fashion, so to speak; 1-2, 3-4, 5-6, etc., illustrates the idea. The "fringing" was thus reduced to such an extent that it became negligible.

Technicolor exposes simultaneously, using beam-splitting prisms, and there is not the slightest "fringing" possible in this process. One of the series of separation negative images is right-side up, and the other series in inverted—these two series alternating in succession on one film running vertically as usual.

Those using single strip twolcolor negatives are:

Colortone—Jones—Kodachrome—Photocolor—Technicolor.

6. *Printing From Master Positive, Instead of From Original Negative*

Kodachrome.

7. *Color in the Negative Direct*

Wolffe-Heide.

The underlying principle here is the same as in the bi-pack method, but the two emulsions are carried on one surface

Visitron Photoelectric Cells

Table of standard Visitron photoelectric cells, showing the essential characteristics and the makes of sound equipment using each size

Standard Visitron P.E. Cells	Height, not Including Prongs	Style of Base	Bulb Diameter	Maximum Voltage	Sound-on-Film Equipment in Which the Various Standard Visitrons may be Used. (List subject to correction.)
53-AWB	2¼″	no base	⅝″	90 volts	Picphone; De Forest (Gen'l Talk. Pic.); Kinoplay; and Tobis.
58-AWB	2″	no base	⅞″	90 volts	Audiphone; Auditone; Duo-Fone* (old equip.); Elec-Tro-Fone; Monarch*; Phototone* (old equip.); Rapid Film; Sonofilm*; Syncrofilm (Weber).
58-A	2½″	small UX	⅞″	90 volts	Brinner "Perfectone"; Duo-Fone* (new equip.); Kinetophone; Ruby Portable; Synchrofone (Stamper).
59-A	3 9/32″	small UX	1″	90 volts	RCA; Vocaphone.
71-A	2 29/32″	standard UX	1½″	90 volts	Belotone; Bestone* (new equip.); Cinevox; DeVry Portable; Dooleyphone; Motiograph (Enterprise); Fox Electric; Masterphone; Goodall*; Homes, Indianapolis Sound Equip.; Kautz "Perfectone"; Lincrophone; Mellaphone; Pacent; Pictur-Fone; Phototone* (new equip.); Preddey*; Royaltone; Royal Amplitone*; Saf-Ray (Simplimus); Douglas (Slipper); Talkiephone; Universal*; Wonderphone; Moviephone; Tone-O-Graph*.
73-A	2⅞″	standard UX	1 15/16″	90 volts	Preddey*.
75-A	3 13/16″	standard UX	1¾″	90 volts	Carter "Dramaphone."
79-A	4¼″	Special prongless base with leads	2 5/16″	90 volts	Preddey*; Ultraphone; Western Electric.

[*This table prepared exclusively for* INTERNATIONAL PROJECTIONIST]

* Asterisks show that the equipment indicated has more than one model, one model of which can use the cell indicated.

There are also 8 special Visitrons designed particularly for use in equipments not listed above. For further information apply direct to G-M Laboratories, Inc., 1735 Belmont Ave., Chicago, mentioning this publication.

of the negative, in two separately applied layers. Raw stock is specially made for this purpose by Afga. The old panchromatic cine negative stock made by Eastman, prior to their "Type 2," was of this type, although not intended for coloring after development. This company's commercial panchromatic film (for stills), was, and probably continues to be, made with an ortho (green sensitive), layer, and a red sensitive layer. With both layers naturally being sensitive to blue, the film takes all visible colors.

We can take a negative of this type, after the final washing, and transform it to a *two-colored negative* by "double-toning." The top layer would be converted to a common blue *tone* (not a tint), and the bottom layer next to the celluloid could be toned uranium (orange). The positives are made on the same kind of stock, but of slower speed, and the coloring is carried out in the same manner as in the negative. The cameras and printers are the same as in black and white, without alteration.

8. *Chemically Produced Colors, With or (Principally), Without Addition of Mordanted Dye*

Colorfilm — Harriscolor — Jones — Magnacolor — Multicolor — Pathe Coloratura—Sennett-Color—Wolff-Heide.

9. *Mordanted Dye-Tones (Silver Iodide Mordant)*

Brewster—Colorcraft—Photocolor.

10. *Combination of Chemical (Blue) Tones and Dye-Tones*

Colortone—Ives.

11. *Images in Pure Dye Only*

Kodachrome—Technicolor.

12. *Hydrotype Positives*

Technicolor.

In this method the printing is effected by a photographically produced "relief matrix" charged with water-soluble aniline dyes, contacted for some minutes with a damp blank film coated with clear hardened gelatine. The contacting, or printing, is performed on an endless steel belt with special sprocket teeth along the two edges, this being necessary in order to register accurately the two succeeding impressions.

There are, of course, two matrices for each finished print. These matrices are recharged with dye after each printing, and thus a number of prints can be made from the same matrix. The printing does not require the usual "dark-room" precautions, it being carried out under white light. As this particular printer is well patented, no one has yet attempted to copy it.

The late Max Handschiegl was the first to use this principle, utilizing a circular drum arrangement for contacting and registration. In the silent picture "Wings" the flame effects of the falling airplanes were done by the Handschiegl process, sometimes called "spot coloring." Subsequently, another attempted to make prints (2½-color), by using the Handschiegl machinery, but did not have much success.

WILLIAM F. CANAVAN SAYS:

IT is true, of course, that an able projectionist must be a good mechanic, but it does not naturally follow that a good mechanic would be an able projectionist. My impression of the matter is that real showmanship is one of the most essential qualities for the real projectionist. He must be show-minded in all that the term implies, with a background of theatrical experience which will imbue him with that inherent theatrical spirit,—'The Show Must Go On,' no matter what may happen. No amount of academic training could possibly produce an outstanding projectionist. The essentials for good projection are not to be learned out of books alone. True, the theoretic approach will be of value to the novice and will be highly beneficial to the experienced projectionist; no man ever lived who knew as much as he ought to know. When any man reaches a point where he imagines he has all the knowledge he should have, it is a certain indication of his need of it.

13. *Keller-Dorian Process*

Kodacolor — Kislyn — Paramount-Publix—Liquid Air Corp. (N.Y.).

A scientific term for this process would be "3-color additive lenticulated film." As the Kodacolor process has been explained in detail on many occasions, we need not go into detail on it here. The method was invented and patented by Albert Keller-Dorian in France. Well-informed technical opinion does not hold this process to have much chance of success on 35 mm. film.

14. *Three-Color Additive Simultaneous Projection*

Chronochrome, Gaumont — Featherstone—Opticolor—and all forms of the Keller-Dorian process (which see).

Chronochrome is owned by Eastman Kodak Co. The colors are almost a perfect match of the original scene which, of course, cannot be said of 2-color subtractive positives. It requires a special camera with three lenses, a special projector with three lenses, and an extra assistant near the screen to register the three simultaneously projected images by remote control.

In all of these processes the shrinkage of the film, both in negative and positive prints, is one of the greatest obstacles to success.

15. *Three-Color Linear Mosaic Film*

Warner-Powrie.

In this process the colors, while additively produced, appear in the negatives direct, in the printed positives, or in the "direct positives." A remarkable feature of this process is the high degree of uniformity of colors obtained, there being no visible fluctuation. About twenty-five years have been spent in an attempt to develop this process which, while simple in principle, has proven difficult to put on a manufacturing basis. It can be used for newsreel work, as the positives can be printed from bi-pack (resulting in 2-color) and processed exactly the same and as fast as black-and-white.

It is intended, however, that this process will find its first application in 16 mm. photography.

16. *Four-Color Simultaneous Additive Projection*

Cox Multi-Color.

17. *Intended for Wide Film*

Magnachrome (2-color successive additive with alternate dyed frames).

18. *Wide Film Masking Proportions*

Chronochrome, Gaumont (35 mm. with frames three perforations high).

19. *For 16 mm.*

Kodacolor — Warner - Powrie — Vitacolor.

20. *Sound Track Inconvenient or Impractical*

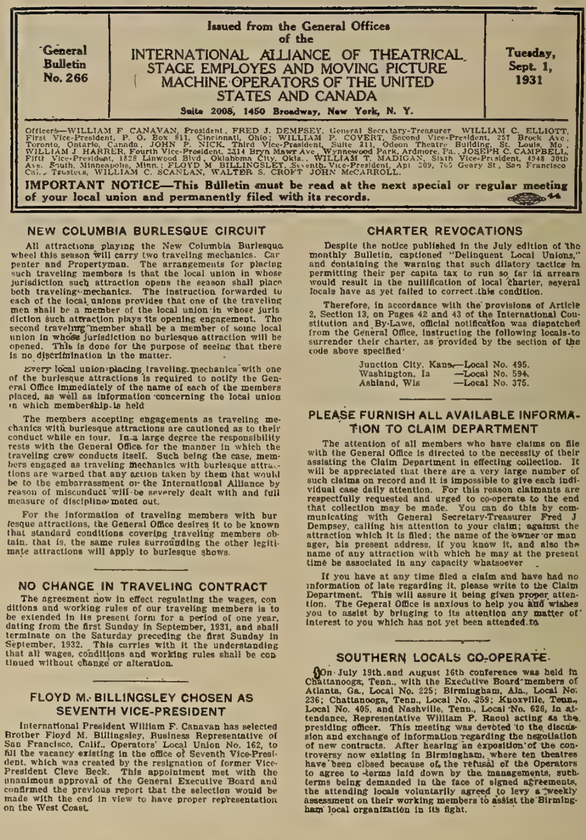
Keller-Dorian—Kodachrome—Warner-Powrie.

[*This is the first of a series of articles on color photography and projection. Color film projection will be discussed by Mr. Robach in an early issue.*—Editor.]

EVOLUTION OF THE I. A. BULLETIN

R. O. Baker

SECRETARY-TREASURER, L. U. 269, LAWRENCE, KANSAS



General Bulletin No. 266

Issued from the General Offices of the INTERNATIONAL ALLIANCE OF THEATRICAL STAGE EMPLOYES AND MOVING PICTURE MACHINE OPERATORS OF THE UNITED STATES AND CANADA

Suite 2008, 1450 Broadway, New York, N. Y.

Tuesday, Sept. 1, 1931

Officers—WILLIAM F. CANAVAN, President, FRED J. DEMPSEY, General Secretary-Treasurer, WILLIAM C. ELLIOTT, First Vice-President, P. O. Box 811, Cincinnati, Ohio; WILLIAM P. COVERT, Second Vice-President, 257 Brock Ave., Toronto, Ontario, Canada; JOHN P. NICK, Third Vice-President, Suite 311, Odeon Theatre Building, St. Louis, Mo.; WILLIAM J. HARRER, Fourth Vice-President, 2314 Bryn Mawr Ave., Wynnewood Park, Ardmore, Pa.; JOSEPH C. CAMPBELL, Fifth Vice-President, 1828 Linwood Blvd., Oklahoma City, Okla.; WILLIAM T. MADIGAN, Sixth Vice-President, 4948 30th Ave. South, Minneapolis, Minn.; FLOYD M. BILLINGSLEY, Seventh Vice-President, Apt. 309, 765 Geary St., San Francisco, Cal.; Trustees, WILLIAM C. SCANLAN, WALTER S. CROFT, JOHN McCARROLL.

IMPORTANT NOTICE—This Bulletin must be read at the next special or regular meeting of your local union and permanently filed with its records.

NEW COLUMBIA BURLESQUE CIRCUIT

All attractions playing the New Columbia Burlesque wheel this season will carry two traveling mechanics. Carpenter and Propertyman. The arrangements for placing such traveling members is that the local union in whose jurisdiction such attraction opens the season shall place both traveling mechanics. The instruction forwarded to each of the local unions provides that one of the traveling men shall be a member of the local union in whose jurisdiction such attraction plays its opening engagement. The second traveling member shall be a member of some local union in whose jurisdiction no burlesque attraction will be opened. This is done for the purpose of seeing that there is no discrimination in the matter.

Every local union placing traveling mechanics with one of the burlesque attractions is required to notify the General Office immediately of the name of each of the members placed, as well as information concerning the local union in which membership is held.

The members accepting engagements as traveling mechanics with burlesque attractions are cautioned as to their conduct while en tour. In a large degree the responsibility rests with the General Office for the manner in which the traveling crew conducts itself. Such being the case, members engaged as traveling mechanics with burlesque attractions are warned that any action taken by them that would be to the embarrassment or the International Alliance by reason of misconduct will be severely dealt with and full measure of discipline meted out.

For the information of traveling members with burlesque attractions, the General Office desires it to be known that standard conditions covering traveling members obtain, that is, the same rules surrounding the other legitimate attractions will apply to burlesque shows.

NO CHANGE IN TRAVELING CONTRACT

The agreement now in effect regulating the wages, conditions and working rules of our traveling members is to be extended in its present form for a period of one year, dating from the first Sunday in September, 1931, and shall terminate on the Saturday preceding the first Sunday in September, 1932. This carries with it the understanding that all wages, conditions and working rules shall be continued without change or alteration.

FLOYD M. BILLINGSLEY CHOSEN AS SEVENTH VICE-PRESIDENT

International President William F. Canavan has selected Brother Floyd M. Billingsley, Business Representative of San Francisco, Calif., Operators' Local Union No. 162, to fill the vacancy existing in the office of Seventh Vice-President, which was created by the resignation of former Vice-President Cleve Beck. This appointment met with the unanimous approval of the General Executive Board and confirmed the previous report that the selection would be made with the end in view to have proper representation on the West Coast.

CHARTER REVOCATIONS

Despite the notice published in the July edition of the monthly Bulletin, captioned "Delinquent Local Unions," and containing the warning that such dilatory tactics in permitting their per capita tax to run so far in arrears would result in the nullification of local charter, several locals have as yet failed to correct this condition.

Therefore, in accordance with the provisions of Article 2, Section 13, on Pages 42 and 43 of the International Constitution and By-Laws, official notification was dispatched from the General Office, instructing the following locals to surrender their charter, as provided by the section of the code above specified:

Junction City, Kans.—Local No. 495.
Washington, Ia —Local No. 594.
Ashland, Wis —Local No. 375.

PLEASE FURNISH ALL AVAILABLE INFORMATION TO CLAIM DEPARTMENT

The attention of all members who have claims on file with the General Office is directed to the necessity of their assisting the Claim Department in effecting collection. It will be appreciated that there are a very large number of such claims on record and it is impossible to give each individual case daily attention. For this reason claimants are respectfully requested and urged to co-operate to the end that collection may be made. You can do this by communicating with General Secretary-Treasurer Fred J. Dempsey, calling his attention to your claim; against the attraction which it is filed; the name of the owner or manager, his present address, if you know it, and also the name of any attraction with which he may at the present time be associated in any capacity whatsoever.

If you have at any time filed a claim and have had no information of late regarding it, please write to the Claim Department. This will assure it being given proper attention. The General Office is anxious to help you and wishes you to assist by bringing to its attention any matter of interest to you which has not yet been attended to.

SOUTHERN LOCALS CO-OPERATE

On July 19th and August 16th conference was held in Chattanooga, Tenn., with the Executive Board members of Atlanta, Ga., Local No. 225; Birmingham, Ala., Local No. 236; Chattanooga, Tenn., Local No. 259; Knoxville, Tenn., Local No. 405, and Nashville, Tenn., Local No. 626, in attendance, Representative William P. Raoul acting as the presiding officer. This meeting was devoted to the discussion and exchange of information regarding the negotiation of new contracts. After hearing an exposition of the controversy now existing in Birmingham, where ten theatres have been closed because of the refusal of the Operators to agree to terms laid down by the managements, such terms being demanded in the face of signed agreements, the attending locals voluntarily agreed to levy a weekly assessment on their working members to assist the Birmingham local organization in its fight.

Reproduction of the front page of the General Bulletin, official organ of the International Alliance, as it appears today

ALTHOUGH the establishment of a craft publication was one of the earliest problems confronting the Alliance, seventeen years elapsed before an official publication was achieved. In fact, twenty-two years passed before the Union possessed a permanent and continuing organ.

The second president of the Alliance, Lee M. Hart, thought the matter so important that he recommended to the 1895 Convention the publication of a journal. His recommendation evidently was the result of a desire for some means of unifying the new organization. Pointing to the results obtained by craft papers of other unions, he suggested a similar publication for the Alliance, adding that it might well prove a source of revenue as an advertising medium. Such a journal, he said, would contain the officers' quarterly reports, "as well as other general news of the order and of matters pertaining to our profession"[1]. The proceedings do not show that the convention ever acted upon President Hart's suggestion.

At the same Convention (1895), however, a resolution was presented for a "bulletin or journal to be issued not less frequently than once a month, and this to be the official organ of the Alliance"[2]. This resolution was indefinitely postponed.

1895 *Membership Small*

It is interesting to speculate upon the reasons for the adverse vote. Financial difficulties and the small membership probably were chiefly responsible. Per capita tax was at this time only 20 cents a year; and the total membership of the I. A. surely did not exceed 2,300. (The financial statement shows that per capita was paid to the American Federation of Labor on only 2,000 members.) The total receipts reported at the 1895 Convention were less than $700.

Two years later (1897), a letter from W. F. Cummings, Secretary of Cincinnati Local No. 5, was read to the convention. Mr. Cummings suggested publishing a weekly paper, the size of which was to be 27 in. x 38 in., 5 columns, 8 pages. He thought that it should be named "The Grip." According to his plan, each local would be entitled to 85 yearly subscriptions and six inches of advertising each week. In return, each local union was to pay $10 monthly in advance. The plan, if adopted, was to go into effect when 43 local unions had signified their willingness to participate. The convention voted to table the letter.

At the same time a resolution was presented by the Cincinnati Local calling for adoption of the Cummings plan; moreover, a second resolution was presented by the Toledo Local calling for the adoption of the *Toledo Union* as the official organ. These resolutions were considered simultaneously. After considerable discussion, the delegates adopted (unanimously, according to the convention proceedings), the motion of Delegate Kelly to make the *Toledo Union* the official paper. This action automatically disposed of the Cummings' proposal.[3]

At the annual convention in Omaha the following year the delegates voted to rescind the action of the preceding convention. Instead of the *Toledo Union* the delegates selected the *Illustrated Times* as the official organ.[4] Just how long the latter remained the official paper is not shown by the convention proceedings.

Again at the 1907 Convention a resolution was introduced which sought to have the Alliance publish its own official journal; but definite action looking toward publication of an organ was deferred until "such future time as ways and means can be found . . ."[5] And at the 1908 Convention, Mr. Hart, who was then Secretary-Treasurer, presented figures to show the cost of publishing a trade journal. By order of the Convention the question of establishing an official journal was sent to the local unions for a referendum vote.[6] A year later, Mr. Hart presented the results to the delegates: the vote stood 1,399 for a journal and 462 against, although several locals asserted their votes had been incorrectly counted.[7]

The First "Journal"

The first issue of the *I. A. T. S. E. Journal* was dated April, 1910. It is certain that at least four issues were published—April, May, June, and July. Although the convention proceedings[8] would lead one to believe that the *Journal* was also published in August and in September, 1910, the librarian of Johns Hopkins University says the library records show only the first four issues named above. Thus, the *Journal* was published for only a short time and then suspended. No reason for the suspension, or the date thereof, can be found in the printed proceedings; and, although it is customary for publications to announce any suspension in their concluding numbers, nothing of the kind was done in the *Journal*. In the absence of definite information, it is reasonable to suppose that financial difficulties may have caused the suspension.

During the administration of Charles C. Shay, the *Journal* was reestablished by order of the 1915 Convention.[9] Monthly publication was commenced in October, 1915, and continued until June, 1920, when the present *General Bulletin* was established.

Financial troubles did not cause the demise of the *Journal* in 1920, (only in-

sofar as many members objected to the 5 cents charge made for this purpose), since there was a balance of more than $10,000 in the Journal Fund on this date.[10] But Secretary-Treasurer Lemaster, at the 1919 Convention, had spoken of the lack of cooperation being received from local unions and from individual members in furnishing news items and their correct addresses for delivery of the *Journal*.[11] This may have a motivating factor in the suspension.

The "General Bulletin"

For three and one-half years the *Generl Bulletin* was issued weekly. On January 1, 1924, it was made semi-monthly.[12] President William F. Canavan explained this change was due to the heavy financial burden of weekly publication and also because "the news was not of direct nature." This, he added, was contrary to the purpose of publication.[13]

Semi-monthly publication was continued until May 6, 1925, when the International officers decided to issue the *General Bulletin* but once a month. The announcement of this change stated that "inasmuch as the majority of the local unions hold their meetings once a month, it is believed this policy will best serve the interests of all concerned"[14]. It was also intimated that the money saved on the printing of the extra issue each month could be used elsewhere to good advantage.

The *General Bulletin* continues today as a monthly publication.

REFERENCES:

[*Note*: *The following references, but one, refer to the Combined Convention Proceedings.—Ed.*]

[1] Page 18 (1895 Convention); [2] page 23 (1895 Convention); [3] pages 43, 45—47 (1897); [4] page 62 (1898); [5] page 253 (1907).

[6] Page 266 (1908); [7] page 316 (1909); [8] page 375 (1910); [9] page 356 (1915); and pages 599 and 609 (1917).

[10] Page 747 (1922); [11] page 680 (1919); 785 and 805 (1924); [13] pages 785 and 805 (1924); [14] General Bulletin No. 191, April 21, 1925.

Recurrent Reproducer Noise

THE sources of noise of an intermittent or recurrent nature are usually much more difficult to locate than are the causes of steady noises. The very fact that such noises come and go intermittently makes it difficult to know when the cause has been located. Preventive measures are therefore much more effective in dealing with such noises than are remedial measures.

The causes of intermittent noises are briefly: Batteries—run down, loose connections; fuses—corroded, dirty clip contacts; charging panels—loose connections; amplifiers—loose connections; poor tube contacts; faders—dirty contacts; motor generators—brushes, commutators; motor generator filters—loose connections.

Noisy "B" Batteries

As B-batteries (dry type), deteriorate, they tend to become noisy and should, therefore, be replaced when the voltage drops below the proper figure. This is especially true of the "C," or grid, batteries, which are used in some of the earlier type amplifiers. Spring terminals on these batteries should be kept clean and care taken to make certain that firm contact is maintained with the spring terminals inside the battery boxes.

Charging Batteries

The tops of storage batteries must be kept clean and dry. They should occasionally be wiped off with a cloth moistened with either a solution of bicarbonate of soda or ammonia. The connections should be kept tight and properly protected from acid fumes by the use of non-oxide grease.

It is well to remember that immediately after batteries have been charged, gases will still be forming in the electrolyte. These cause slight variations in the internal resistance of the battery, resulting in noise being introduced through the amplifiers. Batteries should therefore be taken off charge at least 30 minutes before the sound system is needed.

Fuses sometimes become corroded internally, and frequently dirt collects or corrosion occurs at the ends where they fit into the clips. Either of these conditions may result in noise. This is especially true of the battery fuses in the 90-volt photo electric cell and film amplifier circuits.

Connections and knife-switch contacts should be checked occasionally to reduce the possibility of noise from loose connections and poor contacts. At the time of installation, all connections are made secure. Subsequently, however, vibration may cause these connections to work loose, with the resulting possibility of noise. The switch-blade contacts on the battery charging panel should be kept clean and bright by occasional cleaning with fine sandpaper.

Vacuum Tubes

Amplifiers, especially the first stages following the photo electric cell or disc pick-up, are very sensitive, and inspection of them at periodic intervals of, say, one month, is good insurance.

Vacuum tubes should be removed in order to clean the contacts on the ends of the prongs and the spring contacts of the tube sockets. The eraser on an ordinary lead pencil is excellent for this purpose, but care is necessary to insure that none of the rubber particles remain on the contacts after cleaning. A file or sandpaper must not be used. The spring pressure should be noted when the tube is replaced. Appreciable pressure is necessary to insure good contact, and if this pressure is lacking, the contact springs of the socket should be bent up to increase the pressure.

All power should be turned off while work of this nature is done, in order to prevent shocks or damage to the equipment. Grid leak contacts should be cleaned, and spring contacts should hold the grid leak firmly in place to prevent noise due to poor contacts.

P. E. C. Amplifiers

The photo electric cell amplifier is suspended in a crade by coiled springs so that it is free to swing without touching the metal amplifier housing. An occasional inspection is advisable to make sure the amplifier is swinging freely and the springs have not become stretched.

It is essential that the anode block associated with the photo electric cell be securely fastened down and that the anode lead from the cell has sufficient slack to prevent the transmission of vibration. The amplifier wiring should be inspected for signs of loose connections. If they exist, loose connections are quite likely to result in intermittent noises, the causes of which may prove to be exceptionally puzzling.

Rheostats, potentiometers and keys should have their contacts cleaned occasionally. The time so spent will be well worth while in preventing noise from these sources.

Fader Contacts

Fader contacts will give little trouble if they are cleaned occasionally with chemically pure carbon tetrachloride. Ordinary carbon tetrachloride should not be used for this purpose. After cleaning the contacts with tetrachloride, a thin coating of vaseline should be applied and the excess wiped off.

If a motor generator set is used for filament or plate voltage supply, it is advisable to make weekly check inspections of the condition of the brushes and commutator. If it is equipped with a filter, the connecting straps should be checked to make sure they are tight.

Particles of dust or dirt may occasionally lodge in the light gate and cause noise if they move due to the machine vibration. Ordinary care in routine cleaning will prevent trouble from this source.

NEW 3 x 4 STANDARD APERTURE FOR PROJECTION

THEATRE screens will be a standard shape for the first time since sound pictures were introduced, if a proposal favored by a majority of Hollywood studios is adopted by both the studios and the theatres. Improved photographic effects and more efficient use of the image space on the film are expected to result. The height of all screens will be three-fourths the width, a proportion first established by Edison in 1889 and used until three years ago when the sound track was put at the side of the film and the picture consequently became more nearly square.

A majority of the studios have ratified standardizing specifications drawn up by the Academy of Motion Picture Arts and Sciences. Theatre practices are now being surveyed, and if the change is found to be practical for a majority of theatres, pictures photographed according to the new dimensions will probably be ready for release by the first of the year (1932). In the meantime, all theatres will be given detailed data from which to make the comparatively slight and inexpensive changes in projector apertures and screen masks which will be necessary to bring about uniformity.

Leading Studios Approve

Studios which have notified the Academy to date that they are in favor of making the proposed change include: Educational, Fox, Hal Roach, Metro-Goldwyn - Mayer, Paramount - Publix, RKO-Pathe, RKO-Radio, United Artists, Universal, and Warner Brothers-First National.

The establishment of uniform 3 x 4 proportions for theatre screens is expected to settle a production difficutly which has vexed studios and theatres since the sound track method of recording was introduced. The studios have had to photograph actors and scenery so that the picture could be shown on an oblong screen in some theatres and on a virtually square screen in others, depending on the method of sound recording used and other mechanical factors. This has frequently resulted in part of the top, bottom or sides of the picture image being cut off the screen.

The picture image will be photographed on the film in 3 x 4 proportions as it is to appear on the screen. The sound track will be left on the film as at present, but the frame lines between the picture image will be made wider. Extensive research and study were necessary to secure the exact specifications for the new standard as allowances had to be made for progressive shrinkage in the film stock and the accuracy of registration in cameras, printers and projectors. It was found possible to use the space on the 35 mm. film more effectively than when sound pictures were first introduced, and the new standard will permit the studios to use four per cent. more area for dramatic action than was possible while variation in theatre screen shapes had to be provided for.

The camera aperture proposed is .651 inch by .868 inch, allowing for a theatre projector aperture of .615 inch by .820 inch.

Basis for Standardization

This is the second step in the standardization of apertures begun by the Academy in 1929. It is made possible now by the decrease in the use of sound-on-disc and the increasing number of theatres which use a reduced 3 x 4 proportional aperture.

The original Academy specifications were made to take care of an emergency situation. A large number of theatres using sound-on-film had given up the nearly square Movietone screen shape for mechanical and other reasons and were insisting on using a reduced aperture in 3 x 4 proportion. Consequently the heads and feet of characters were being cut off, since the studios at that

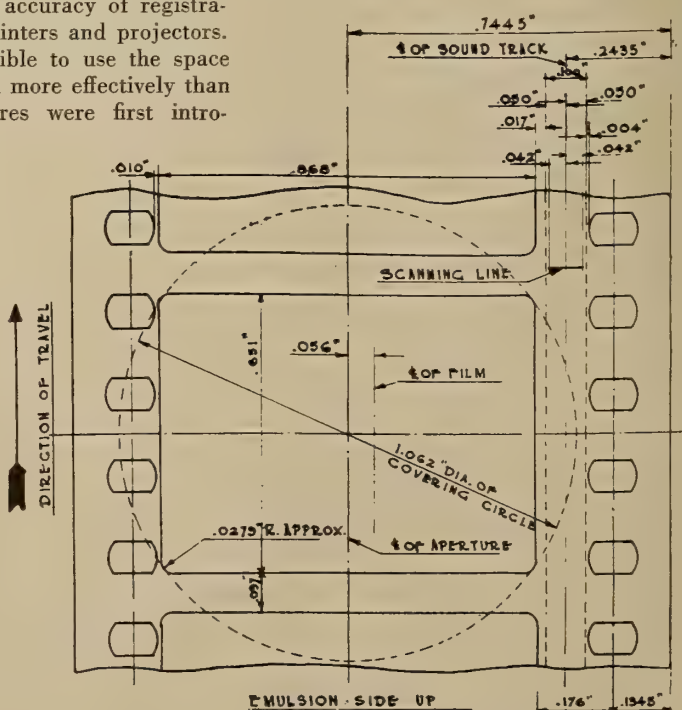


FIG 1. CAMERA APERTURE

The dimensions indicated provide the maximum aperture which will leave an adequate margin of safety. It should be emphasized, however, that laboratories should print both picture and sound track with the greatest possible accuracy. In the drawing the center line of the right hand side sprocket holes is used as the base center line for calculting all dimensions, since cameras and printers register at this point

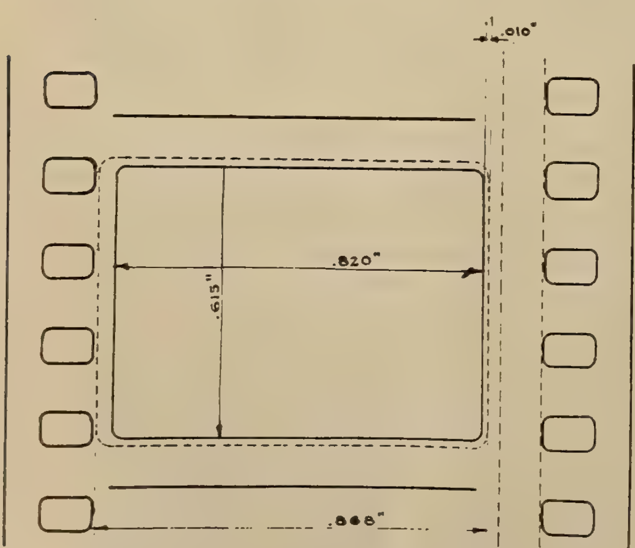


FIG. 2. PROJECTOR APERTURE

The projector aperture dimensions have been stated on the basis of projection-on-the-level, as no uniform provision for the keystone effect can be made. The calculations have been carried out with due regard to the fact that in projectors the film is controlled at the right-hand edge

time were photographing for the full height of the frame.

The Academy made a national survey of the situation (the results of which are given in Table A), and found that something had to be done—although there was still so much full-frame disc release that it was too early to standardize. As a temporary measure the Academy then recommended that all vital action be kept within a 3 x 4 rectangle marked on the camera glasses of such size that the picture would not suffer when projected through a reduced proportional aperture. For the past year cameramen have thus had to fill about twenty per cent. of their frame—the ten per cent. of sound track area, five per cent. at the top, and five per cent at the bottom—with non-vital action or unessential views of the set.

Re-Centering Methods

Probably the most difficult problem in connection with the reduced aperture method (*A* in Table A), is to re-center the picture after it has been enlarged. The amount masked out from the top and bottom of the picture in reducing the aperture is calculated to balance the increased magnification so that from the standpoint of height the picture will fit into the screen frame.

Magnification extends the left margin of the picture to cover about half of the blank strip. The right margin is extended an equal amount beyond the black border so that the picture must be moved to the left in order to be properly centered.

Several other aspects of the reduced aperture practice are worthy of notice herein, as follows:

1. The shorter focal-length length increases the graininess of the picture on the screen. No theatre reported this as a serious defect.

2. One theatre chain called attention to the fact that the smaller aperture slightly reduces the amount of light that gets to the screen. Due to the fact that the size of the picture is increased, this reduced light must cover a larger screen area. However, there has been no indication that this constitutes a serious problem.

The Framing Problem

3. The projectionist's problem of keeping his picture in the frame is more difficult and requires painstaking care. Although the cameraman may keep his action within the smaller area he usually fills up the balance of the frame with foreground and background for the benefit of theatres using the standard aperture. This means that the projectionist finds no indication on the picture as to the exact line of its upper and lower limits. More is dependent upon his own judgment than formerly and his responsibilities are greater.

The proposal now is to mat off this useless space in the camera and standardize the American industry on the 3 x 4 proportions preferred by the theatres. By careful calculations it has been found possible to use a little more image area on the film than has been included inside the marks on the ground glass and thus give four per cent. more image area for vital dramatic action to reach the screen.* The proposed standard apertures for all pictures are:

* NOTE.—The question of the relation of the motion picture aperture to a possible aperture for television was brought to the attention of the sub-committee by the Television Committee of the Radio Manufacturers Association. The standard specifications allow for an adaptation to the requirements of television when such adaptation may be commercially desirable.

New Camera Aperture: .651″ x .868″
(Corners to be rounded by an arc of a circle of .0279″ radius)

Replacing the present:
Ground glass markings of: .620″ x .835″ in the
Mitchell aperture of: .720″ x .923″ and the
Bell & Howell aperture of: .720″ x .969″

New Projector Aperture: .615″ x .820″

Replacing the present:
Most commonly used proportional of: .600″ x .800″
Movietone aperture of: .680″ x .800″
Old silent aperture of: .680″ x .906″

(Continued on next page)

Table A. *Summary on Theater Aperture Practices*

Theater Chain	Projector Aperture Policy for Sound-on-Film Pictures	Projector Aperture Dimensions for Sound-on-Film Picture*
Publix Theaters, Inc.	Method A standard for all larger houses	0.593″ × 0.796″
Loews, Inc.	Method A standard for all larger houses	0.607″ × 0 800″
Fox-West Coast	Method A standard for all houses. About 65 houses already installed	0.597″ × 0.796″
Fox-New England	Method B in all houses; if no better improvement by fall, will adopt Method A	0.680″ × 0.820″ (approximate)
Balaban and Katz	Method A standard for circuit	0.609″ × 0.815″
Warner Brothers-Skouras Bros. Circuit	Method B in all theaters	0.680″ × 0.820″ (approximate)
Saenger Theaters	Method A standard for circuit for Silent and Vitaphone as well as sound-on-film	0.610″ × 0.829″
Universal Theaters	Methods B, C, and D	0.680″ × 0.820″ (approximate)
Commerford Theaters	Method A standard for circuit	0.600″ × 0.810″
R. B. R. Amusement Company	Methods B, C, and D	
R. & R. Circuit	Methods B, C, and D	
R. C. A. equipped theaters. (R-K-O, *etc.*)	Method B standard for all houses	0.687″ × 0.812″
	Method A in not more than 5%	0.624″ × 0.812″

*S.M.P.E. standard projection aperture—0.680″ x 0.906″.

When sound track only is masked out the aperture is reduced to approximately 0.680″ x 0.820″.

Simplex standard apertures—Vitaphone or silent picture, 0.679″ x 0.904″.
—Movietone picture, 0.6093″ x 0.7968″.

Method A—Combination of Reduced Aperture with Shorter Focal Length Lens.—An aperture is inserted in the film gate which masks out, in addition to the sound track, a portion from the top and bottom of the picture sufficient to reduce the height to about three-fourths of the reduced width. The smaller 3 by 4 picture is enlarged by a one-half inch shorter focal length lens to fill the screen. Recentering is accomplished by auxiliary devices which enable the lens on the machine o be moved from right to left. Unless due allowance has been made in production for this smaller aperture vital portions of the picture will almost certainly be cut out. The estimated cost of installing this method is $200.

Method B—Movable Mask or Flipper.—A movable mask or flipper about 30 inches wide at the left side and facing the screen changes the screen shape to correspond with the picture shape. When sound-on-film pictures are being shown it is moved over to cover the blank strip on the left of the screen. The flipper is operated by a stage hand, some member of the regular house staff, or by remote control from the booth.

Method C—Blank Strip on the Left Side of Picture.—A sliding plate masks out the sound track. A blank strip shows on one side of the screen.

Method D—Small Blank Strip on Each Side of the Picture.—Rather than leave a blank strip on the left side of the picture some theatres shift the projection machine in order to center the picture, so as to divide the blank area between the two sides.

Specifications for the standard apertures as worked out by the subcommittee in consultation with studio and equipment company technical representatives are shown in the accompanying illustrations (Fig. 1 to 4). Some of the factors and conditions considered are given in the following analysis by J. A. Dubray of the subcommittee:

1. For Negative Films

a. The plus and minus camera tolerances which include the location of the aperture (constructional tolerances); the size of the aperture (constructional tolerances); and the side weave of the film on the register teeth of the intermittent mechanism.

b. The plus and minus tolerances which must be allowed in accumulating the camera tolerances with a ½% film shrinkage.

2. For Positive Films

c. The plus and minus tolerance required in printing a positive and calculated first from the effect of registering the positive film against the right-hand side of the teeth of the main printer sprocket while the negative registers against the left-hand side; second, from the effect of registering the positive and the negative films in the opposite direction. Both cases for unshrunk positive and accumulating with the tolerances arrived at (b).

d. The plus and minus tolerances calculated from the (c) tolerances plus a positive film shrinkage of ½%.

e. The plus and minus tolerances calculated from the (c) tolerances but with the addition of a positive film shrinkage of 1½%.

The results obtained from the above have been derived with the assumption that the negative has only shrunk ½%. However, since the shrinkage effect constantly progresses through the printing process as well as while the films are stored away, the calculations have been extended to include a greater negative shrinkage.

The following series of computations was carried out, accumulating the plus and minus camera tolerances, with the tolerances necessitated by the various conditions expressed above, with the exception that a maximum 1½% shrinkage of the negative was considered instead of the minimum ½%.

3. For Negative Films

a′. Camera tolerances same as for (a).

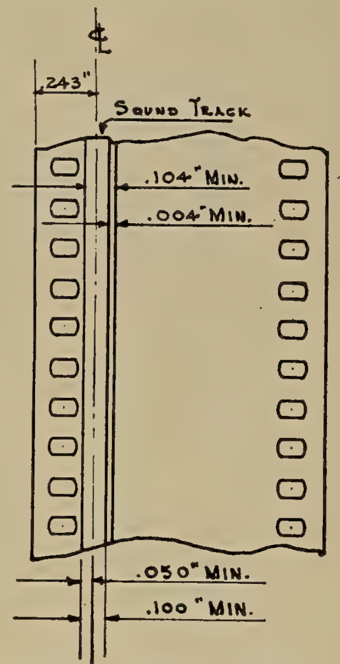


FIG. 3. SOUND TRACK
This drawing is a detail from Figure 1 to show the minimum requirements for sound track width and location

b′. Tolerances resulting from accumulation of (a′) and 1½% negative shrinkage.

4. For Positive Films

c′. Tolerances required in printing with unshrunk positive for both conditions of film registration expressed at (c), but accumulating tolerances calculated at (b′).

d′. Tolerances calculated through the accumulation of tolerances at (c′) and ½% shrunk positive film.

e′. Tolerances calculated through the accumulation of tolerances (c′) and ½% shrunk positive film.

The latest being the extreme case, accumulating a maximum permissible shrinkage and all constructional and register tolerances taken from the camera, the registering tooth, the processing of both positive and negative and those of the printing of the positive film, which are due to the differences in shape and dimensions of the positive and the negative perforations.

The above method of determining shrinkage and mechanical tolerances has resulted in the determination of a maximum camera aperture as illustrated in Fig. 1.

Taking the above dimensions and computing according to the accumulated tolerances determined at (d), (e), (d′) and (e′), the maximum and minimum dimensions of sound track and picture area of positive film are derived as shown in Fig. 4.

Advantages to Studio

1. *Economies.*—Cinematographers estimate that from a half-hour to an hour a day now spent in setting up for composition in three apertures—full frame, Movietone frame, and proportional—can be saved or devoted to improved photography. Scaffold lights can be lowered from three to five feet, thus making possible a reduction in the wattage or number of units.

The tops of large sets can be lowered by as much as six feet, and all sets can be reduced in width by nearly ten per cent. without making any change in the placing of essential action and props as photographed for the past year.

2. *Improved Quality.*—A single aperture will make for better composition on the set for both the cinematographer and the director. The studios will be assured that the picture will be projected as it was photographed. Projectionists have had wide leeway in framing and no guide to show them when their proportional aperture was centered until they saw heads or feet cut off on the screen.

Microphones can be lowered from three to five feet, resulting in an obvious advantage in sound quality and convenience for the sound department. Camera lenses can be re-centered on the new aperture for better optical coverage.

Advantages in Theatre

1. All pictures can be projected through a *single standard aperture*, doing away with movable flippers and changes of screen masks, aperture plates and lenses during the show.

2. The frame lines just outside the aperture as they used to be for silent pic-

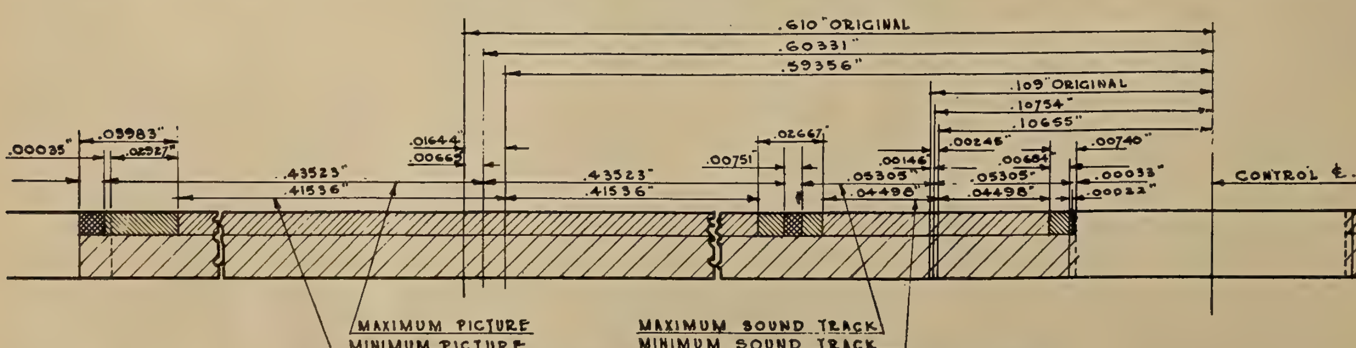


FIG. 4. MINIMUM AND MAXIMUM SOUND AND PICTURE AREAS
This drawing is a composite view of the dimensions resultant from the calculation of shrinkage and mechanical tolerances from which Figure 1 was derived

tures will be a help to the projectionists in keeping in correct frame. If the picture should momentarily go a little out of frame the projectionist will be warned by seeing a frame line, but as the lines are wide, the mis-frame can be corrected before the audience notices it.

3. Standardization of exact dimensions by the studios will give the projectionist more uniform prints from the various companies.

4. Theatres now using reduced proportional apertures will gain four per cent. more screen image without additional magnification.

5. Theatres now using the Movietone aperture or the old silent aperture will gain the advantage that the studios can fill the whole area of the new standard aperture with essential dramatic action and will not have to leave a border of unimportant picture.

Studio Equipment Changes

Cameras: New apertures at a cost of about $25 per camera; new ground glasses; adjustments to re-center lenses.

Laboratories: Minor adjustments depending on the present practice followed by the laboratory. *Art Departments:* New camera angles. *In Viewing Rooms:* Adjustment of projector apertures and screens.

Theatre Equipment Changes

1. Theatres now using reduced proportional apertures: (*a*) File out apertures to larger size or insert new plates; (*b*) Enlarge screen by about four per cent. of area.

2. Theatres now projecting in Movietone proportion: (*a*) Insert new aperture plates; (*b*) Either move the screen masks in from the top and bottom; or (*c*) install shorter focal-length lens and widen the screen.

3. Theatres now projecting full-frame silent or full-frame with disc sound: (*a*) Insert new aperture plates; (*b*) Recenter head of projectors; (*c*) Either, move screen masks in on all sides, or (*d*) install shorter focal-length lens to enlarge image to present screen.

Possible Objections to the Proposed Change

1. A large part of foreign release is now on full-frame disc, and foreign exhibitors are accustomed to showing American product in this way. This is probably the most important objection to the proposed change, even though foreign release is a comparatively small item. However, the same considerations of studio economy will also apply to foreign producers and it is probable that they will follow Hollywood's lead. Foreign theatres now showing full-frame can make the same adjustments American theatres have made. If they make no adjustments at all the picture will not be hurt except to show a heavy black border on the top, bottom and left side.

2. There will be a period when prints with different apertures are circulating side by side. While this is true of any standardization, the committee considered that the advantages will far outweigh any temporary inconvenience. Theatres will be given the necessary instructions in advance and *should not make the changes until they begin to receive most of their bookings on the new standard.*

3. Many theatres are unable to afford expensive changes in equipment. In answer to this it may be pointed out that this change puts no burden on the theatre. The new frame can be projected if necessary without any changes in apertures or screens whatever, and the only harm will be that a black border may show around the picture. The theatre can get rid of this by installing new aperture plates at a maximum cost of $3 and putting a rim of black paint around the screen or moving the screen masks in at very slight expense.

4. If an individual theatre does not want to install shorter focal-length lenses, and has been showing silent pictures or sound-on-disc pictures through the old silent aperture, the change will reduce its screen size by about eighteen per cent. If a theatre has been showing sound-on-film through a Movietone aperture the change will reduce its screen

The New Standard 3 x 4 Aperture

THE proposed new standard 3 x 4 aperture constitutes a technical advance of major importance. The introduction of sound pictures presented many difficult problems to the motion picture technical worker, but certainly none as serious as the matter of screen image, for a badly-proportioned screen image hit the industry where it hurt most—in the pocketbook. One need only glance at the accompanying analysis of theatre aperture practice (*Table A*), to become convinced of the extreme seriousness of this problem.

Projectionists will naturally delve into the specifications of the proposed new standard in order to learn just how their work is affected. Complete details are supplied in the accompanying article, thus only the highlights of this phase of the standard need be cited here: (1) Uniform prints, the lack of which heretofore has occasioned serious damage to projection in particular and the industry in general; (2) a larger screen image without additional magnification; (3) vastly improved facilities for framing, which until now has been largely a hit-or-miss affair by the projectionist, and (4) a *single standard aperture* which will eliminate movable flippers and changes of screen masks, aperture plates and lenses during the show. These various improvements may be effected with an inconsequential expenditure and a minimum of effort.

Changes in production equipment and procedure are included in the accompanying article so that the projectionist may be fully informed regarding all phases of this problem and thus be better able to appreciate the various factors entering into the process and ultimately affecting his work.

A word of warning anent this proposed new standard: No changes should be made in the theatre until the standard is officially adopted, immediately after which the necessary information will be sent to every theatre in the country. Barring unforseen developments, prints made according to the new standard should reach the first-run theatres after January 1 next.

We feel that we should not let pass this opportunity for paying tribute to all those who participated in the work of setting-up this new standard. This long and arduous task is one more red-letter achievement by the Academy of Motion Picture Arts and Sciences. One need not look far for the reason for the remarkable success enjoyed by the Technical Bureau of the Academy. Under the very able direction of Mr. Lester Cowan (now Executive Vice-President of the Academy), this department has won its spurs by concerning itself with the *practical* side of technical problems, the while it left the theorizing, the speechmaking and the production of high-sounding but inocuous platitudes to those who were content to do this rather than be concerned with that which obviously is their true function.

JAMES J. FINN

area about seven per cent., unless shorter focal-length lenses are installed.

In answer to these statements it should be pointed out: first, that the area being matted off has not contained any vital action during the past year and so has contributed little to entertainment value; second that standardization of the 3 x 4 proportions responds to a strong demand from the theatre field; third, that to the increasing number of theatres using a reduced proportional aperture the change will mean a four per cent. larger screen image without additional magnification.

Addenda

The following item[1], although not a part of this article, provides an interesting sidelight on screen proportions.

A supervising projectionist of one of the largest theatre chains in his reply to our inquiry raises a very pertinent question. He says:

"The matting off at the top and bottom of the picture seems essential to members of the profession but the thought occurs to us, 'Does the shape of the projected picture matter to the general public?'" Our curiosity aroused, we put the question of the comparative advantages of the square and rectangular screen among others, to Dr. Walter R. Miles of Stanford University. Dr. Miles is professor of experimental psychology and an outstanding authority in his field. He was passing through Hollywood on his way east to attend international congresses of physiology and psychology. His comments on the proportions of the screen are given below.

According to the view of Dr. Miles, the physical nature of the eye as well as long habit is against the nearly square shape of the sound-on-film picture for the motion picture image as compared with the rectangular shape silent picture. He says:

"No generation of man is entirely free from former generations. Whether this is accident or intention it is hard to determine. If we make a survey of the tools and household articles that were used in Egypt as compared to those that are used today we find, perhaps to our surprise, considerable uniformity in shapes and sizes. For example, there is an optional size and weight for the hammer that is used in one hand. There is an optional size and shape for the hand mirror to be used by a woman. Many illustrations of this come to one's mind.

"The proportions of the rectangle have been a subject of scientific study since about 1875. At that time it was noted that man, in using the rectangle in nearly all of his buildings, furniture, and conveniences, adopted a ratio which was strikingly different from the perfect square. Although there is no correct exactness in this ratio it tends to be about five to eight, a combination which has been called the golden cut, frequently found in crosses, windows, *et cetera*. The formula has been: the short side is to the long side as the long one is to the sum of the two. This must not be regarded as a law to be striven for or which will bring punishment if it is transgressed.

"If we seek for a basis in the physiology of the eyes and in the psychology of perception the following points come to our notice. The eyes have one pair of muscles for moving them in the horizontal, but have two pairs for moving them in the vertical. Vertical movements are harder to make over a wide visual angle. As man has lived in his natural environment he has usually been forced to perceive more objects arranged in the horizontal than in the vertical. This has apparently established a very deep-seated habit which operates throughout his visual perception. Perhaps we can see the whole thing typified in the opening through which the human eye looks; it is characteristically much wider than it is high.

"One final feature in the psychology of visual perception is that the vertical axis is over-estimated. A true square looks about three units too high.

"We therefore see conformity with man's general experience as well as with the accepted art practice in projecting a picture that is wider than it tall."

Upon his return from the East Dr. Miles took pains to reassure us that some of the leading physiologists and psychologists of the world with whom he had discussed this very interesting subject had in general confirmed his opinions. This is very interesting especially in view of the fact that the proportions of some of the wide films in use are two to one and the opinion expressed by Dr. Miles gave eight to five as the proportion for maximum efficiency.

[1] We are indebted to Mr. Lester Cowan, Executive Secretary of the Academy of Motion Picture Arts & Sciences, for this very interesting addition to this article.—Editor.

DIVIDENDS FROM PENNIES

Kendall Emerson, M.D.

MANAGING DIRECTOR, NATIONAL TUBERCULOSIS ASSOCIATION

[*The reason for the inclusion of this short article in this publication is obvious. Every year at this time attention is focused on the very important work which is being done as a result of the sale of Christmas seals, and every publisher worth his salt gladly cooperates with the National Tuberculosis Association in the form of space donations for advertising and editorial copy. The splendid work of this organization is of special significance to the projectionist craft, so many members of which have good reason to be thankful to those who purchase Christmas seals.*—Editor.]

WHAT do you get when you buy Christmas seals? Most obviously, of course, you receive little pieces of paper which you stick on letters and packages during the holiday season, both as an expression of good-will toward humanity, and an example to induce others to buy them.

But there is something else you get which is shared by all—and that is improved community health, which, to get right to the point, means you have a greater chance to live a longer life.

Seals are sold to fight tuberculosis. This disease is still the arch-enemy of man, killing more people between the ages of 15 and 45 than any other ailment. Each year sees a falling death rate from this cause, and there is every reason to expect this record of success to continue in the future, if the pennies of the public do not fail in supporting the warfare against the scourge. But the battle has not yet been won by any means.

It is imperative to continue the work which the Christmas seal has been doing. Unknown tuberculosis cases must be ferretted out and placed under care in the early stages; children who already show evidence under the X-ray that they are candidates for active disease a few years hence must be found and safeguarded; summer camps and clinics in many places need support; public health nurses are required in others. These things and many others the Christmas seal penny helps to do. Foremost, perhaps of its achievements, is the campaign of general education which is ceaselessly waged to inform the public of the nature of the disease; how it spreads by contact from the sick to the well; how the sick must be discovered and the contact broken. Getting patients under treatment in sanatoria is important, but the greatest advance against the disease is along preventive lines. By raising the standard of popular knowledge people are enabled to protect themselves, advancing the arrival of the day when sanatorium care will be unnecessary.

Tuberculosis in the United States wipes out the equivalent of a medium-sized city every year. It has been estimated that to endure the disease as it now exists for the next twenty years would cost the nation more than twenty billion dollars. In the last twenty years education and sanitation have combined to cut the death-rate in two.

Will the public continue to give the pennies, the dimes and the dollars needed in the next twenty years to abolish tuberculosis, or will it allow tuberculosis to take from it twenty billions of dollars and hundreds of thousands of lives? That is the challenge which the nation answers every Christmas, when everybody, rich and poor, buys Christmas seals.

The IP EDITORIAL PAGE

Vol. 1, No. 2 NOVEMBER 1931

This Matter of Film Mutilation

The problem of film mutilation has been with us since the introduction of the motion picture. Some of the best executive and technical brains of the industry have studied the problem in detail in an attempt to provide solution, but to no avail. Repeated failure reflects no discredit upon the gentlemen who have bent their talents to this task, for the matter is one that requires a detailed knowledge of all branches of motion picture endeavor—production, distribution, equipment and film manufacturing, and reproduction—which is asking a bit too much of any one mortal. This job requires collective effort by specialists in every branch of the art, and the lack of such effort heretofore is a plausible reason for the many failures recorded.

The motion picture industry is not unlike any other great industry in that it suffers as a result of that artful little game which is popularly known as "passing the buck." Mention film mutilation in any gathering of technicians and immediately "the buck" is started on its journey. Film manufacturers pass to equipment manufacturers; from here a pass is made to the exchanges, who, in turn, pass to the projectionist, who has no alternative but to defend himself by "passing the buck" right back. The participants are very adept at this game, but their efforts contribute nothing to a solution of the problem of film mutilation.

Now along comes the Projection Practice Committee of the S.M.P.E., under the chairmanship of Harry Rubin, with an announcement of a program for investigating this whole matter of film mutilation and, if possible, providing the answer. This intent of Chairman Rubin is commendable, and we wish him every success in his efforts. We wish we could prophesy with certainty a tremendous success for this program, but our experience in such matters prevents us from doing so.

Let us assume that the Projection Practice Committee pierces the very core of this problem and as a result thereof promulgates certain recommendations anent future practice. Such a report would be read before the Society, printed in the *Journal* and then, if past experience be any guide, be promptly forgotten by everyone except those men who had worked hard and long to prepare the recommendations. This will never do.

One does not have to look far for the reason why this should be so. The reason lies in the fact that not one important executive in the motion picture industry has a clear perception of technical activity within the industry. Most of these executives think they have discharged their obligations to the technical forces when they have written a complimentary letter to be read at a technical society's banquet, or when they are quoted in some trade paper to the effect that they think "the technicians have done splendid work for this great industry of ours and we wish them every success"—or some such palaver. These same executives know their business in every other respect, though: actor's salaries, wages, equipment costs, distribution costs, box office reports, and the like. But what they don't know about the technical phase of the business would fill several libraries of good size. These men forget that the technicians make money for them by improving quality and reducing the cost of getting that quality, just as surely as does the star who wears well at the box office. But try to convince them of that.

The Standard Release Print saved the producers $100,-000 within six months after its introduction. Yet, when this writer interviewed one of the ranking executives in the business on the subject and at the same time attempted to secure a small donation for the Projection Advisory Council (which organization aided greatly the introduction of the S.R.P.), he found that this "ranking executive" had never heard of the S.R.P. (P. S. Also, he didn't get the money.) Such is this business.

We have strayed far from the subject of film mutilation, but the foregoing serves very well to indicate just what the technicians are up against in formulating a definite program. Film mutilation, and any similar problem, requires more than anything else an active interest by and the support of the excutives of this business. With such support assured, many existing technical problems would be comparatively easy of solution.

As for the specific matter of film mutilation, the answer lies not in committee reports, trade paper comment, fire insurance statistics or/and complaints from the technical field workers. Assuming the existence of an active interest on the part of the industry's executives, the matter should be put squarely up to a board to be composed of representatives of, say, the following: (1) producers (2) exhibitors (3) exchange operations supervisors (4) projector manufacturers (5) projection supervisors (6) technical societies (7) fire underwriters, and (8) film manufacturers. There may be one or more omissions to the foregoing list.

With such a board applying itself diligently to the problem, the answer should be forthcoming quickly. And once established, the board's recommendations should be *enforced*. Such a board would put a stop to all this silly "buck passing" and would place the responsibility squarely where it belongs.

A. P. S. Looks to the Future

We note with considerable pleasure that arrangements have been made for reorganization of the American Projection Society. Direction of the Society, long vested in the Eastern faction, has now passed to a West Coast group which has demonstrated its capacity for leadership. An up-and-doing educational and fraternal organization is an absolute necessity to the projectionist craft, and we look to the American Projection Society to provide such a service.

THE ART OF CONTINUOUS CINEMATOGRAPHY

William C. Plank

IN this article we shall submit to projectionists various reasons why the art of continuous cinematography advances precision in projection to a higher standard. In cinematography, precision will always remain the predominant thing; and old and less accurate methods must invariably give way to newer and more precise ones. That is the handwriting on the wall that everyone can read. Precision is always useful, but never more so that when it is dedicated to the comfort of the eyes and the preservation of vision. And in no other direction can it be applied to a more generally useful purpose than in improving motion picture projection.

It is axiomatic that the most precise and perfect method of dividing a motion picture film into evenly spaced divisions or frames is by imparting a uniform motion to it, and spacing off the divisions by the beats of a pendulum or the regular periods of a rotary body revolving at a uniform velocity. This is the fundamental principle of the registration in the continuous cinematograph. And the thing that makes it important and full of interest is that the ideal can be approached more closely upon this principle than upon any other.

Freeing the registration from the tyranny of the perforations and permanently establishing it upon the basis of uniformity of motions or the law of inertia, is the outstanding achievement of the continuous cinematograph. Many improvements proceed from this revolutionary innovation in the principle of registration. The most important of these are undoubtedly the ones that conspire to greater perfection in the projected image, for they directly concern the public.

Major Advantages

It should be a matter of interest to the public, therefore, that the art of continuous cinematography offers six optical improvements, all of which contribute to the comfort of the eyes and the preservation of vision, or to the quality and beauty of the image.

These are:

I. A characteristic steadiness or smoothness in the projected image, derived from the extraordinary precision of the registration. The cumulative effect of the more precise registration improves the definition, increases the contrast, and lessens eyestrain.

II. A restful quality that is more pleasing to the eyes. This is due to the continuity of the illumination made possible by the elimination of the dark-periods. It is a quality that is immediately perceived and remarked upon by many.

III. The much longer stationary-period which is made possible, improves the half-tones and increases the depth and "snappiness" of the image.

IV. A more perfect and natural reproduction of motion. This is one of the most important of the improvements made possible through the art of continuous cinematography, for it adds life and action to the image. It tends to correct the jerky mechanical quality of motion pictures. The reason will be found to reside in two distinct phenomena. The first of these is the creation of composite or intermediate postures during the blending period. These composite images take the place of the usual dark-periods in intermittent projection, and thus very appositely fill in the blanks in the record.

In Figure 1, the thin hand of the colored boy illustrates one of these intermediate postures, for it will be observed that it is half-way between the faint outlines of the two original postures from which it is created. Our rhomboidal[1] prism projector was stopped at the dissolve-period and the two images of adjacent film photographs were thus superposed upon the screen, and photographed.

It will be noticed that corresponding parts of the two superposed images remain unaffected by the blending, but those parts that do not coincide (the parts that were in motion in the object), become partly obliterated by the highlights of the complemental frame. Where these parts overlap, however, the highlights cannot affect them and a conspicuous intermediate posture or pose is created. The thin hand of the colored boy constitutes such a composite posture, for it can be proved by shutting off

[1] A four-sided figure having its opposite sides equal, and its angles not right angles; lozenge-shaped.

Figure 1

Figure 2

the light to each frame, that the upper outline of the hand and wrist belongs to one film image while the lower one belongs to the other. Above and below the thin hand and wrist, the faint outlines of the two original postures can be made out. Note also, that the index finger of the hand does not appear in the intermediate posture because it failed to overlap. The case in which light parts move upon a dark background may also be demonstrated.

Irradiation

The second phenomenon that enters into this art cannot be accounted for excepting upon the principle of irradiation.[2] A narrow fringe or border (either of light or shadow), adjoining a larger area, will make the larger area appear to expand or move, with a variation in the illumination of the fringe. We often see examples of this phenomenon in advertising signs with raised letters that cast shadows. The variations in the illumination give an apparent motion to the letters.

For similar reasons the thin arm of the colored boy will appear to expand upward or thicken to the limit of the upper outline of the fringe, if the fringe be gradually darkened until it is the same shade as the rest of the arm. This apparent motion depends upon the variation of the illumination, and hence it is gradual and continuous and the equivalent of a succession of postures. It will be understood, of course, that these simulations of motion can occur only when there is an overlapping of the parts, and when the separation of the original postures is not too great.

In watching this interesting phenomenon, and passing the film photographs through very slowly, it will be noticed that many of the couples give only a very crude representation of motion; but then again, others delight us with the grace and ease of the movements.

Thus it is that this new art fills-in the dark-period with a real intermediate posture and a continuous succession of apparent ones. And in doing this, it performs a twofold service, for it eliminates flicker, and adds movement and life to the image. This unique property is the basis for a fair imitation of slow motion when the rate of projection is reduced to three or four frames a second. And in amateur cinematography it is invaluable, for it makes possible the taking and projecting of motion pictures at the surprisingly low rates of four to eight frames a second.

The substantial saving thus effected represents the toll that flicker is now exacting of the amateur. More than half of the cost for film goes out for apparently no better purpose than to speed up so as to make the flicker imperceptible to the eyes.

Showing two frames fully superimposed during the dissolve period. This tends to reduce graniness. The half-values of the highlights cannot be caught in a photograph, however: they show as white as the full values

Depth Possibilities

V. Unusual third-dimensional effects, which are inherent in the dissolving or blending principle of the substitution. The two images superposed upon the screen at the same time are, undoubtedly, the chief reason for the noticeable roundness or plasticity of continuous projection.

In Figure 2, the lap-dissolve is illustrated more strikingly by a frame of titles superposed upon a picture. If the film gate were here titled slightly with respect to the optical axis, the focal planes of the two images would separate, one of the images moving farther back of the other along the optical axis. It will be seen, therefore, that if the film photograph be moved downward from the upper position of the double aperture to the lower one, its image will occupy, successively, the more remote plane, the intervening planes, and then the nearer one; and that at full projection speed, all of these planes will be filled with a sharply-defined image. This is another of the unique effects that can be obtained in this art, and which may be employed to accentuate the third-dimensional effect with an appropriate screen.

Better Color Results

VI. Better results in natural color projection, for the reason that the restrictions as to the rates of projection are removed, and methods giving better definition may be employed.

In a recent article[3] the present writer has summarized the mechanical advantages of the continuous cinematograph as follows:

1. A higher order of precision. 2. A more uniform and longer sustained accuracy. 3. The mechanism has fewer parts and is of the heavy duty type. 4. Oiling nuisance is avoided, and the sound track and picture surfaces are kept free from oil.

5. Noiseless operation. 6. Freedom from vibration, as all the moving parts are balanced and revolve at a uniform velocity. 7. Momentum of the prism-wheels tends to overcome certain inaccuracies in the mechanism. 8. Momentum of the film overcomes many inaccuracies in the perforations. 9. Wear on the perforations has less effect on the projection.

10. Momentum of film prevents sudden lateral movements. 11. Elimination of tension shoes possible, as a loose loop of film can be made to press itself with sufficient flatness against the aperture plate. 12. Elimination of tension shoes makes possible the use of raised or embossed margins on the film, thus forming an air-space and preventing scratches on the sound track and picture surfaces when wound up.

13. Absence of tension shoes eliminates the effects of variations in the thickness and smoothness of the film; and the effects of variations in the "give" or flexure of the film at the perforations when under a severe strain. 14. Minimum of strain and wear on film. 15. Fire hazard reduced as there is less possiblity of the splices parting. 16. Moving film fans itself, so withstands higher temperatures. 17. Even distribution of heat reduces buckling of frames.

18. Most of the work of pulling the film may be allotted to the frictional contact of the sprocket drum. 19. Minimum of work for the sprocket teeth prolongs their life. 20. Fewer and smaller perforations may be used. 21. The need of only one row of perforations, thus giving room for a wider sound track or a wider picture. 22. The use of one row of perforations eliminates errors in parallelism in the perforations and in the sprocket teeth, and makes for greater precision in the registration.

Misleading Propaganda

The advantages of the continuous cinematograph are, in fact, so many and so obvious that it is no wonder inventors throughout the world have directed their attention to its development. Several continuous cinematographs have been designed of such rugged and simple construction as to leave no doubt that they will stand up well under use.

The charge that the continuous projector is impractical has been widely circulated in technical journals, to the prejudice of the art of continuous cinematography, and to the misleading of motion picture engineers. But obvious propaganda should deceive no one. And every one should know that the acid test for practicability is practice—the capacity for useful service. In its capacity for delivering uniformly accurate projection through a long period of time, the continuous projector stands out conspicuously among cinematographs. Its period of accurate use may be estimated at from five to fifty times as long as that of vibrating mechanisms. No greater claim to practicability can be made.

[NOTE.—*The second and concluding article in this series will appear in the next issue.*—Ed.]

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[2] A ray of light; emission of heat rays; apparent enlargement of a bright object upon a dark ground.

[3] "Some Interesting Properties of Continuous Projectors," *Journal, S.M.P.E.* (*June*, 1931), **Vol. XVI**, No. 6.

MATHEMATICS FOR THE PROJECTIONIST

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IT is the purpose of this article to excite the interest of the projectionist in an elementary study of mathematics. Explanations of certain equipments, prints, graphs, schematics and the like are often presented to a projectionist who has never had an opportunity of familiarizing himself with the elements of mathematics, the lack of knowledge of which often renders valueless much material which otherwise would offer much of interest. This series of articles will attempt to make up this deficiency.

This and succeeding articles will be prepared on the assumption that the reader knows nothing about mathematics. Those who are familiar with some of the material presented herein are asked to bear with their fellow craftsmen and the author until the series is more advanced; but in any case, even this elementary material will serve this class of readers as a review.

In the average textbooks on algebra and geometry is found a mass of data which is of little practical use to the projectionist. For this reason the reproduction herein of a major part of such textbooks would be unjustified. A special effort has been made to deal only with the practical aspects of mathematics, and it is believed that this course will best serve the purpose of these articles.

Mathematical Language

It is necessary that the reader have an adequate knowledge of the language of mathematics—and by this is meant an understanding of the terms and symbols used, just as in music there is a language comprised of terms and symbols. Let us first consider that which is commonly referred to as a "formula."

What is a "formula"? A formula is simply a mathematical equation, which we may consider as a hopper, into which one pours certain information, then turns the crank—and out comes the answer. The mechanical analogy of a formula to a hopper is indeed illustrative. Working out a formula is a process from which the *unknown* is derived by supplying the *known* factors.

Beyond the use of formulæ lie terms like "perpindicular," "bisection," "vertex,' and the like. Let us first familiarize ourselves with these terms.

By definition, a "straight line" is a continuous succession of points. "Points" are the boundaries of these lines. A "curve" is spoken of as a series of infinitely small straight lines. An "angle" is the space bounded by two insersecting straight lines. By "bisecting an angle" is meant the cutting of an angle into two smaller equal angles, the sum of which is equal to the original angle. In "trisecting an angle" we do the same thing, but in three equal parts. This latter process is very difficult.

The "vertex" of an angle is the point of intersection of the two bounding intersecting lines. "Perpendicular" is a line which is set at right angles to to another straight line. In any circle there are 360 degrees. If two diameters intersect each other within a circle, and do so perpendicularly, we have four right angles included by these diameters (Fig. 1).

Ratio and Proportion

Ratio and proportion is a common algebraic process knowledge of which is extremely valuable to the projectionist. For example, this process is used to determine the proportionality of two factors, when two other factors vary in some definite ratio. By this is meant that a certain unknown number can be found when three others are known.

Example:

If a current of one ampere can flow through 10 ohms resistance, how many amperes will flow through 5 ohms resistance?

Discussion.

1. The variable terms are the resistances.
2. As the resistance becomes one-half as great, the current becomes twice as great.

Solution:

10 ohms is to 5 ohms as X amperes is to 1 ampere, or

$$10:5 = X:1 \ldots\ldots\ldots \text{(No. 1)}$$

This may also be written as:

$$\frac{10}{5} = \frac{X}{1} \ldots\ldots\ldots \text{(No. 2)}$$

In solving for X, it is necessary that we make X equal to all other terms. In equation No. 1 the colon (:) represents the ratio, and is read as follows: "10 is to 5." This means that 10 ohms is compared with 5 ohms. The "equals" sign (=) represents the proportion or comparison and is read: "As." Now, reading equation No. 1 in its entirety we say: "10 is to 5 as X is to 1." Equation No. 2 is read the same way, the division sign meaning the same as the colon, namely: "is to."

In solving equation No. 1 there are two parts—the "means" and the "extremes." The "means" has reference to the two numbers located on either side of the equals (=) sign. The "extremes" are the two numbers at the ends of equation No. 1. We multiply the means by each other, and let them equal the product of the extremes. This gives us:

$$\underbrace{5 \times X}_{\text{"Means"}} \qquad \underbrace{10 \times 1}_{\text{"Extremes"}}$$

Or:

$$5X = 10$$

$$X = \frac{10}{5} = 2 \text{ amperes,}$$

Answer.

It will be seen that this proportion does not increase directly as the ratio increases. The ratio of the resistances

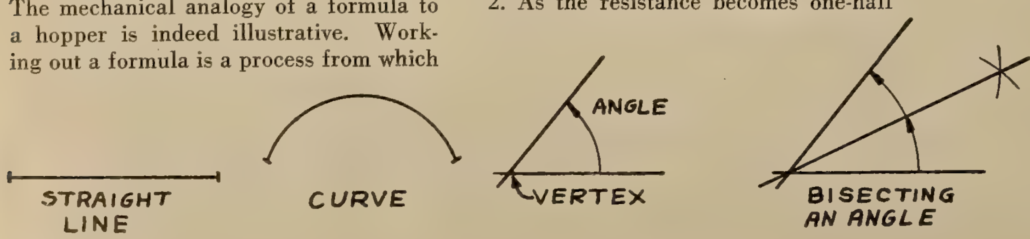


Figure 1

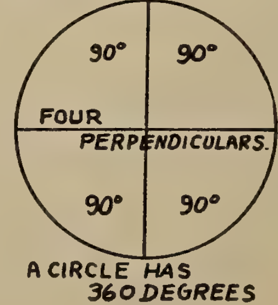
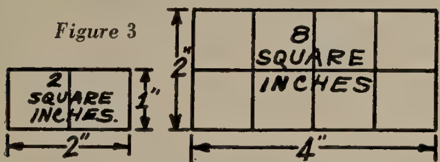


Figure 3



decreased from 10 to 5, or 2 to 1. Yet the amperes increased in the proportion of 1 to 2. This is an example of "inverse" ratio and proportion. This is not the same as "direct" ratio and proproportion. For example:

Problem:

If 5 cents buys 1 apple, how many apples can be bought for 15 cents?

$$5:1 = 15:X$$
$$5 \times X = 15 \times 1$$
$$5X = 15$$
$$X = 3 \text{ apples,}$$

Answer.

The foregoing is an example of "direct" ratio and proportion. Where the number increases directly as the price increases, it will be seen that we compare the price of one article with the price of X articles. In solving any problem like the foregoing, it is always good policy to ask oneself the following:

"A is to B as how many is to C?"

Or:

$$A:B = X:C \text{..........(No. 3)}$$

Or:

$$\frac{A}{B} = \frac{X}{C} \text{.........(No. 4)}$$

In solving equation No. 3 we get:

$$B \times X = X(A \times C)$$

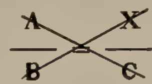
$$\text{Or: } BX = AC$$

If we divide both sides of this equation by B, we get:

$$\frac{BX}{B} = \frac{AC}{B}$$

Or: $X = \dfrac{AC}{B}$ (since B cancels on the left side)

In solving the same proportion by means of equation No. 4 $\left(\dfrac{A}{B} = \dfrac{X}{C}\right)$ a simple method is available. By cross-multiplying we obtain the same result. By this is meant: draw a line from B to X and multiply them together. Draw another line from A to C, multiply them together, and let the product of the first two letters equal the product of the second two letters. Thus:



$$B \times X = A \times C$$

Or:

$$B\,X = AC$$

$$X = \frac{AC}{B} \text{ (dividing both sides by B),}$$

Answer.

Plane Geometry

The Square. The areas of various geometrical figures may be determined by employing simple formulæ. For example: a square is said to be a figure the length of which equals its width. Therefore, a figure having a length of 1 inch and a width of 1 inch is said to be a one-

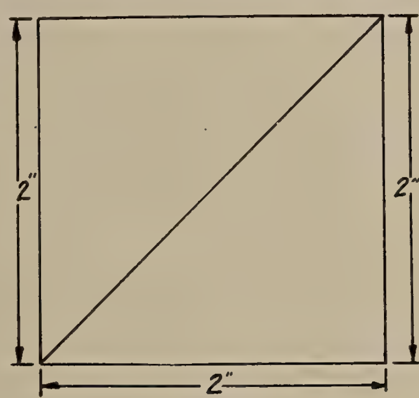


Figure 4

inch square. In mathematics we call this area one square inch. Suppose we extend the length of this square to 2 inches, and also make the width 2 inches. Would we now have 2 square inches? We would have 4 square inches. If the length be 3 inches, and the width 3 inches, we have an area of 9 square inches. (Fig. 2.) The conclusion of this is that the area of a square is obtained by multiplying the length by the width.

The Rectangle

The same that is true for the square is true for the rectangle. A rectangle really is made up from a number of squares. If

Figure 2

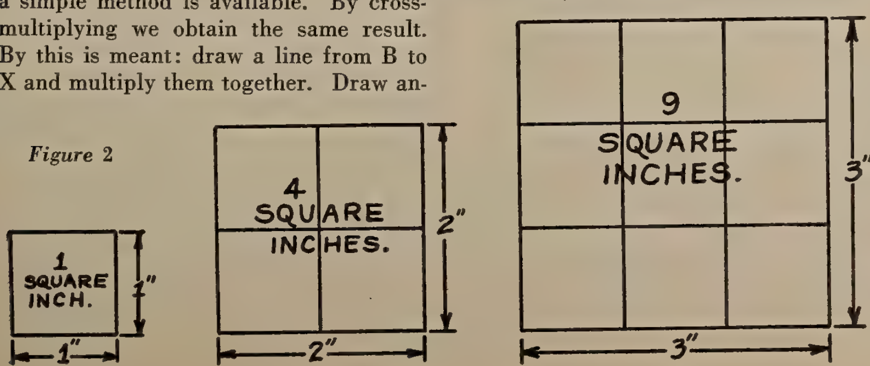
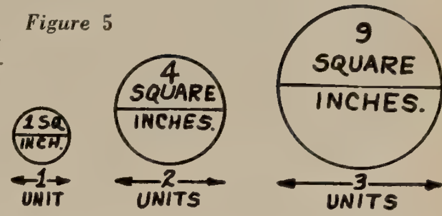


Figure 5



the length of a rectangle is 2 inches and its width 1 inch, the area is 2 square inches. If the length is 4 inches and the width is 2 inches, the area is 8 square inches. In other words, the area of a rectangle is equal to the product of its length multiplied by the width. (Fig. 3.)

The Triangle

The area of a triangle can be computed in a similar manner. Let us consider a square the length of which is 2 inches and the width of which is 2 inches. The area of this square is 4 square inches. Now let us draw a diagonal line within the square so as to divide the square into two triangles having equal areas. (Fig. 4.)

Since the sum of two rectangles is equal to the entire area, then the area of each triangle is one-half the area of the square. Each of these triangles differs from the square in a certain respect. It appears as though a triangle is a square having one of its sides squeezed down to a point. Therefore, the width of the triangle is not 2 inches all the way through. Its width varies from 2 to zero. Its average width is 1 inch. The area of a triangle, then, is measured by multiplying its length by its "average width."

A triangle is said to have an altitude and a base. These correspond to the lengths and the widths of squares. The area of a triangle, then, is the product of the "average base" multiplied by the height or altitude.

Expressed by equation:

$$\text{Area of triangle} = \tfrac{1}{2}\, b\, h \text{.. (No. 5)}$$

where: b = base
h = height or altitude

In the above figures, then, the area of either triangle is 2 square inches, for:

$A = \frac{1}{2} \times 2 \times 2 = \frac{1}{2} \times 4 =$ 2 square inches, *Answer.*

The Circle

The area of a circle depends upon its diameter. If we increase the diameter, the area increases. Therefore, if we know the diameter or the radius (which is half the diameter), we may determine the area.

Let us see how the area of a circle increases with the diameter. Suppose a circle has a diameter of 1 unit and its area is 1 square inch. If we double the diameter, the area does not double. If the diameter becomes twice as great,

measurement shows us that the area is four times as great. If the diameter is tripled, the area becomes nine times as great. In other words the areas of circles do not vary as their diameters, but rather as the squares of their diameters. (Fig. 5.)

We have noted that the areas are proportional to the squares of their diameters. Similarly, they are proportional to the squares of their radii. r^2 indicates the product of $r \times r$, which represents the radius multiplied by the radius. In order to express a proportion in the form of an equation, we introduce a "constant" called *pi* (π), a Greek letter, and assign to it a value of 3.1416, because the areas increase by this constant value as the radii increase. Hence we have the formula:

$$\text{Area of a circle} = \pi \times r^2$$
$$\text{or: } A = 3.1416 \times r^2, \text{ square inches,}$$
Answer.

Solid Geometry

Solid geometry is simply a further application of plane geometry. Instead of dealing with plane objects like a square and a circle, solid geometry deals with objects having three dimensions like the cube and the sphere. By three dimensions, we have reference to length, width, and depth. Professor Albert Einstein, the celebrated physicist, has added a fourth dimension which he calls "time"; but this principle need not be discussed herein.

The Cube

The cube really is a pile of squares. The area of a square is obtained by multiplying its length by its width. To determine the volume of a cube, the dimensions of which are 1 inch long, 1 inch wide and 1 inch deep, we multiply the length by the width, which gives us 1 square inch. We then multiply this area by the depth to get the volume. As a result, the volume of this cube is $1 \times 1 \times 1$, which is 1 cubic inch.

Formula:

$$v = l \times w \times h$$

where: v = volume
l = length
w = width
h = height or depth

The volume of a cylinder is obtained in the same way. The area of the base is πr^2. We then multiply this area by the height to determine the number of circles in this cylinder in cubic inches, by using the following formula:

$$v = \pi r^2 h$$

where: v = volume of cylinder
π = 3.1416
r = radius of the base
h = height of cylinder

(*To be Continued*)

ALLIANCE ITEMS

I. A. Executive Board Meets at Vancouver

THE regular meeting of the General Executive Board of the I.A. was held in Vancouver, B.C., on October 12. Several sessions were held during the course of the American Federation of Labor Convention which had assembled in Vancouver for the customary two-week period.

The initial roll call revealed all members of the General Executive Board present, as follows: William F. Canavan, International President; William C. Elliott, William Covert, John P. Nick, William J. Harrer, Joseph C. Campbell, William T. Madigan, Floyd M. Billingsley, and Fred J. Dempsey, General Secretary-Treasurer.

Due to the resignation of former Third Vice-President Cleve Beck, and the appointment of Floyd M. Billengsley as Seventh Vice-President, each member of the Board, from the office of Third Vice-President on, was automatically advanced, this being the first meeting at which a proper recording of this change was made.

The meeting of the Board was officially adjourned on October 14th.

Charter Installation at Johnson City, Tenn.

FORMERLY under the jurisdiction of Bristol, Tenn., Local No. 530, application was made for charter to cover Johnson City, Tenn., and as investigation revealed the applicants had conformed with all International requirements and were qualified in every other respect, recommendation for granting the charter was filed and approved. Proper installation of the new local union was made by Representative William P. Raoul. A pledge of full support was received from the Johnson City Central Labor Union.

Tube Warm-Up Time Included in Schedule

CORRESPONDENCE transpiring between the General Office and H. M. Wilcox, Vice-President of Electrical Research Products, Inc., is printed herein for the information and guidance of I.A. projectionist members. Compliance with the request contained therein will confer a distinct favor on the interests involved, as, aside from the economical feature it will effect an improved performance:

September 30, 1931.

Dear Mr. Canavan:

We have been co-operating very closely with exhibitors all over the country in an effort to reduce the repair and maintenance costs of sound equipment, and I am glad to state that we have been able to save exhibitors a very substantial amount; in fact, this will run into several thousand dollars this year.

In connection with this it has been pretty definitely proven that the life of vacuum tubes can be extended from 15% to 20% if there is a proper heating up time prior to the use of the amplifiers. This heating up does not need to exceed fifteen to twenty minutes.

Frequently we have statements mad to us that it is impossible to get the operators to give attention to this matter and it occurred to me that you might desire to prepare a general bulletin on this subject, as I know that you, too, have been co-operating with exhibitors generally with reference to the reduction of operating costs, and this will give you an opportunity of giving concrete evidence in a very practical view of helping them to reduce costs. It is in view of this that I venutre to pass this suggestion along.

Cordially yours,

(Signed) H. M. WILCOX,
Vice-President.

Dear Mr. Wilcox:

Answering your letter of September 30th, I assure you that the warming up time is inclusive in all projectionist schedules. My contact with the matter indicates that the time allotted to this service is thirty minutes. It is only too obvious that a proper performance cannot be given under any other circumstance, and you can count fully upon my official aid in seeing to it that all the projectionist local unions have a provision requring the men to properly prepare the sets for operation prior to the opening of the show.

Thanking you for your interest in this matter, I am, with best wishes,

Very truly yours,

(Signed) WILLIAM F. CANAVAN,
International President.

New York and Chicago Locals Victorious

WITHIN the space of a few days of the report of the settlement of New York Local No. 306 in their dispute with the Lee O. Och's interests, word of the favorable termination of the controversy existing between Chicago Local No. 110 and the Independent Exhibitors was received. In each instance, a bitter and resourceful fight was waged by both sides, with the outcome eagerly looked forward to by supporters of Organized Labor and their employers, as it was anticipated the result would have a significant bearing on subsequent issues.

The strained relations previously existant between the local organizations and the controlling interests have been healed and a spirit of harmony and goodwill now prevails, with each co-operating for the success of the industry, which, of course, must be assured and has priority over any individual gain and glory sought. On this common understanding, both may be confident of success.

Indiana Legislative Body Is Reorganized

DISBANDED sometime ago at the discretion of President William F. Canavan, "The Indiana State Legislative Organization" has been reorganized with the permission of the General Office. This new body will function solely as a legislative organization. The formation of this new organization occurred at a meeting held in Fort Wayne, Ind., attended by all Indiana local unions. L. P. McGirr, of South Bend, was elected Secretary-Treasurer.

No time was lost in formulating plans to combat the progress of dual organizations in Indiana. Safety will be the

keynote of a campaign to be launched shortly in municipalities looking toward the betterment of the I.A.

A Member's Dream of a Perfect B. A.

ONE who is capable of creating jobs for the membership when there is none to be had. He must be specially fitted to have a job ready for a member when he reports out of work. He must have abality to defend himself on all occassions—physically and otherwise. He must have influence to get all members out of trouble at all times. He must have sufficient real estate unencumbered so as to be in a position to sign personal bonds. He should have sufficient ready cash to insure the membership small loans, meals, street car fare, lodging and cash checks, etc. He must furnish his own car and a telephone in his home. He must be available to the membership at all times. He must keep himself posted as to know where every member can be located on a minute's notice.

A Few Requisites

He must also be capable of defending a member before all employers, when discharged for a good cause and force employers to maintain men in employment. He must be able to collect all wages for members who are too lazy to do it for themselves. When sending members to a job, he should have sufficient wisdom to give members correct number of days employment and all the tricks to gain overtime which he is not entitled to. He must visit the sick, purchase tickets for bazaars, raffles, picnics and dances and make donations to all political causes and all other worthy causes from his personal funds. He must keep posted as to the conditions of work in other cities and be personally acquainted with all councilmen and judges so he can get released or get jobs for their neighbors and he will be held responsible for all new members accepted into the local.

He must have a pleasing disposition and keep posted on the weather conditions as to tell in advance as to whether the sun will shine or whether it will snow or rain. He must be up on all current events and must know how long it will take a letter to get to Chicago, Detroit, Cleveland or other points. He must be up on all current events to know how to get the best results from radios, automobiles, etc.

S. C. STATE COUNCIL HOLDS ANNUAL MEETING

More than 100 projectionists and theatrical employes from the two Carolinas, all members of the I.A., met in Columbia, S. C., on October 25th, for a conference looking toward betterment of the craft. Paul W. Fuller, educational director of the A. F. of L., addressed the meeting on the subject of wage cuts and the resultant limited purchasing power. Fire Chief Marsh emphasized the need for the cooperation of projectionists with fire authorities in controlling serious theatre fires. W. P. Raoul, I.A. representative, outlined the work of the projectionist craft during the past two years.

Officers of the State Council of theatrical workers for the coming year elected at the meeting were: A. H. Estes, Columbia, president; Ernest Jenkins, Charleston, first vice-president; W. L. Dent, Columbia, second vice-president; George V. Spillers, Spartanburg, third vice-president; Carroll L. Addy, Columbian, secretary and treasurer. The executive board elected by the council will be composed of J. Henry Keener, Charleston; George H. Blackmon, Columbia; A. J. Lancaster, Spartanburg; and Guy Bryson of Greenville.

Columbia was selected for the 1932 meeting place.

Control of A. P. S. Passes to West Coast Group

EARLY settlement of the problem of reorganization of the American Projection Society is expected as a result of a meeting of a special committee of the Supreme Chapter in New York on October 1. The New York faction heretofore has opposed vigorously the reorganization program sponsored by the West Coast chapters, and until very recently there was every indication that this difference of opinion would split the organization into many factions each with its own program. The meeting on October 1, however, developed into a "harmony" session, and the net result is that the wishes of the West Coast groups with respect to reorganization will be acceded to.

At the meeting on October 1 the following members were present: H. Stein, chairman; P. A. McGuire, secretary; Joseph Basson, J, Girvan, and George Edwards, the latter having served until recently as International President. After a general discussion and a unanimous agreement that every effort must be made to "meet the wishes of all chapters," the following suggestions were agreed upon and will be presented to the Board of Governors of the Society for consideration:

Abolish Supreme Chapter

1. Upon recommendation of Brother Edwards the term "Supreme Chapter" is to be abolished and all chapters will be known according to number and location, to illustrate, "New York Chapter No. 1."

2. Brother Edwards advised that a recommendation be made for a change in the constitution, which will enable all chapters to participate in the nomination and election of an International President. Each chapter will elect its own representative to be a member of the International Board of Governors.

3. Brother Edwards further recommended that the International President be empowered to appoint an International Vice-President, an International Secretary and an International Treasurer, preferably from the members of his own chapter. These officers to constitute an administrative body, acting in conjunction with the International President.

4. Brother McGuire recommended that the appointment of an Administrative Board shall be confirmed by the International Board of Governors, who also shall have the power to remove for cause.

5. The International Vice-President, the International Secretary and International Treasurer, shall have no vote in the Board of Governors. The International President shall designate the manager, editor, and location of the official publication of the Society, *The American Projectionist.*

6. The Committee further recommends that the present Board of Governors take prompt action to enable these recommendations to be put into effect without delay. That immediately following the change in the constitution, plans be formulated to arrange for nomination of an International President and election by a secret ballot, which will enable all members of the American Projection Society, in good standing, to vote at the coming election. These recommendations received the unanimous approval of the committee.

Behind all these words is the real story which is that the West Coast chapters will "run" the American Projection Society for the next year at least. After the considerations, the proposals, the unanimous agreements, the letter-writing, the speechmaking, the nominations, and the elections are over with, the West Coast chapters will emerge as the directing faction of the Society.

Seavier for President

Frank L. Seavier, President of San Francisco Chapter No. 16 and one of leaders, if not *the* leader, in the reorganization movement, is regarded as a certainty for International President; and as such he will have the power to appoint the vice-president, the secretary, and the treasurer of the Society. There is general approval among the membership, on the West Coast and elsewhere, of the choice of Seavier as their leader.

The status of *The American Projectionist,* official organ of the Society, still remains in doubt, the decision as to this to be made by the new administrative body.

Immediately following the induction into office of the new administrative body an intensive campaign for greatly enlarging the scope of the Society's work and a drive for increased membership will be launched.

The new administrative body will be installed shortly after January 1 next, a majority of the chapters (including New York), having expressed their approval of the reorganization plan in general, and of the election of Seavier to head the Society.

THIS SOUND AND TELEVISION SCHOOL 'RACKET'

James J. Finn

LATE in 1929 and early in 1930 the sound projection school "racket" flourished and every large city boasted of at least one such school. Thousands of students, baited with glowing promises of $100-a-week jobs, were enrolled in the various schools in all parts of the country. It is difficult to state with any degree of accuracy just how much money was contributed by International Alliance men to these institutions, but the amount may safely be said to be not less than $15,000.

The "racket" reached such proportions that President William F. Canavan of the International Alliance issued a general ban against all such enterprises. Mr. Canavan felt that I. A. men should not contribute money to a school which would supply information, correct or otherwise, on sound projection to men who, in turn, would endeavor to displace I. A. men in their jobs. In addition, he stated, a majority of such enterprises had been proven to be "rackets" in the full meaning of the term.

Conspicuously active in the sound projection instruction field at that time was the Projectionist Sound Institute of Easton, Penna., headed by F. A. Jewell. Mr. Jewell's first move was to announce the formation of a "faculty" or advisory board manned by prominent technical men and designed to inspire confidence in the Institute's course of instruction. At least one well-known electro-technical worker who was also an I. A. man lent his name to this board; but he was quickly forced to resign.

A Bid for Favor

A short time thereafter this writer was visited by Mr. Jewell who outlined the general plan of his course of instruction, gave assurances that he "was on the level" and that his idea of instruction was sound, and solicited favorable "plugs" among projectionists in order to increase enrollment. Naturally, this writer was to have a "cut" on each student secured. It has occurred to this writer several times since that day that possibly Mr. Jewell has not a very warm feeling for his type of person.

This was his last meeting with Mr. Jewell. Projectionist Sound Institute continued to operate, although it is doubtful that it enjoyed any great favor among I. A. men in the light of the formidable opposition it had encountered in this field. Subsequent developments along this line consisted mainly of a few random shots taken by this writer at the general idea of such schools, just by way of a reminder to projectionists.

It can be stated here that the stiff opposition of the I. A. to all such enterprises has been proven to be justified.

Before proceeding further, we should like to direct attention to the notes accompanying this article: one a verbatim reproduction of a recent newspaper story, and the other a "lift" of a report by the Better Business Bureau from the I. A. General Bulletin, 1930 volume. These notes are self-explanatory.

Tinker to Evers to Chance

We come now to October of this year. What do we find? We find in existence the Photo Electric Research Laboratory Corp., the National Sound Service Bureau, Inc., and the Electric Sound Institute, Inc., the latter located in Easton, Penna., and the others in New York City. The first-named is said to be developing a new engraver. The second organization was formed to "service theatres all over the country" in connection with sound picture apparatus. Can it be that the third unit, the "Institute" is, say, a first-cousin of our old acquaintance in Easton? It is; for we note that F. A. Jewell is the recognized head. My, my.

The recognized head of *all* three enterprises, according to the accompanying newspaper story, is F. A. Jewell, and his co-officers are Lester Al Smith, G. C. B. Rowe, and Eric C. Mackey. The activities of the "Institute" and the "Service Bureau" are explained in the report of the Better Business Bureau. But this report does not trace the path of the "student" from the Institute to the Service Bureau to the Photo Electric Research Laboratory. It cannot be denied that this is a swell chain—only so different from the old-fashioned business college which promised jobs to its graduates.

Now that we have the first two companies properly pegged, let us consider the activities of the Photo Electric Research Laboratory.

We turn for our information to *Photoelectricity and Sound,* which obviously is a house organ for all three companies—the soldering element, so to speak. We note that this paper is published in Easton by a company of the same name as the title, and is officered by the following: F. A. Jewell, president; G. C. B. Rowe, secretary and treasurer, and L. A. Smith, vice-president. Familiar names, all.

In Volume 1, No. 1, for October, 1931, we note an article entitled "Photoelectricity and Gold," by L. A. Smith, which captures our interest. This article dwells on the virtues of the new engraving process which P. E. R. L. is developing and suggests that a little extra cash might be

Indict "Sound School" Promoters

Four Promoters Indicted in $200,000 Swindle.

PROMISED STEADY PLACES

Ambitious Applicants Pay to Learn Electric Sound Work.

A pretentious racket which reaped a large income from the savings of unemployed men through promises to train them in electrical sound work and secure for them $50 a week jobs was uncovered today in an indictment filed by the Federal Grand Jury charging mail fraud against the officers of the National Sound Service Bureau, Inc.; the Photo Electric Research Laboratory Corporation, both of 723 Seventh avenue; and the Electrical Sound Institute, Inc., of Easton, Penn.

The men named in the indictment are Fred A. Jewell, Lester A. Smith, G. C. Baxter Rowe and Eric E. Mackey. The corporations are said to have garnered over $200,000 from ambitious applicants who have registered for courses in the institute in the hope of securing permanent employment at a good salary.

Complaints received from many victims of the scheme caused United States Attorney George Z. Medaile to order an investigation. His assistant, lent by Mr. Medalie.
J. Hendrick Terry, spent six weeks on the case and finally presented it to the Grand Jury.

The indictment charges that the defendants advertisezd for men to operate a photo-electric engraver, allegedly invented by Jewell, at a minimum salary of $50 a week.

Applicants were informed that they must first pay $2 for an examination and then become members of the Sound Service Bureau. The membership fee was $25. Only 1 per cent. of those fulfilling those requirements obtained passing mark in the examination and the rest were advised to take a course in the institute.

This course, which held out a guarantee of a $50 a week job or all money returned, cost from $85 to $150. Over 2,000 men, many of them practically destitute, enrolled for the course.

Thus far, according to Mr. Medalie, no $50 a week jobs have materialized and there have been no refunds. The idea, he continued, was sold to the victims in the most highly colored fashion, the defendants holding out that Mr. Jewell's supposed invention, the photograver, would soon establish a world monopoly and that the various affiliated corporations, of which the defendants held all offices, would grow rich and powerful.

Some forty branch offices have been established in as many cities all over the country and high pressure salesmen have been engaged to secure students on a 50 per cent. commission basis. The claims made for Mr. Jewell's new process, which is not patented, were said to be false and fraudulent by Mr. Medalie.

[From *New York Sun*]

made from the process. We reproduce herein excerpts from this article. Get a load of this:

Customers are clamoring for Photo Gravers. Thousands of them must be built and assembled. Scores of men must be immediately employed. Thousands of men must be immediately placed in training and thousands of new members must be secured for NATIONAL SOUND SERVICE BUREAU, INC.—and this must be done with the least possible delay. *SUCCESS* is ours now but it is only the beginning of such a *TREMENDOUS* success, that we can't realize it or believe it.

To sum this whole thing up and to conclude this story, you fellows, who are out there in the field *privileged* to serve in your present capacities, are LUCKY.

There are going to be more ten and fifteen and twenty and twenty-five thousand—yes—and even fifty thousand dollar a year jobs with our associated corporations, than there are warts on a frog's er - rear end, and some of you fellows who are reading this now, are going to be in these jobs. All of you who are reading it have a chance for them.

We have been and are going to continue to grow faster than any other corporation in America. We are going to get so doggone big and have so damn much money that the United States Government is going to have to build new mints, and we are going to have to open up our own banks just to have a place to keep the money—the ones they have now are not big enough.

No matter how wild a dreamer you are, or how vivid your imagination is, or how many shots in the arm you can take, you can't realize what a chance you have here.

Our big jobs are going to be filled from the ranks of the men holding the little ones now, and if you are anything more than the dumbest guy in the world, you want to get sold on that idea and then go out and sell the world on it—for the world is our meat and we are sitting on top of it and we have got it by the tail. So get your coat off—give us every ounce of "guts," brains and energy that you have, and if you can find any place that you can use them that will bring you bigger, quicker returns, I am a cock-eyed hump-backed Chinaman. So let's go—let's hit that old ball—let's triple the pace and boy, oh boy, we will start believing in Santa Claus again—we will begin to pity Rockefeller's poverty and you'll know that God is in his old Heaven and there are more blessings there than there are brickbats in hell—so altogether now—

HEADS UP'
CHIN OUT
FORWARD HO—
WE'RE OFF!!

Not bad, this. What we can't understand is how any man who knows anything at all about the electro-technical arts (projectionists qualify), shouldn't grab this opportunity to make a few extra cookies for the wife and kiddies. We ourselves are tempted to enroll—AT ONCE! The only thing that is holding us back is the possession of a reference[1] bearing on a similar process which is only forty-seven years old. This reference fills us with strange misgivings as to why some other bright person hasn't followed-through on the idea set forth therein.

It is immaterial for the purpose of this story to discuss the merits of this "new" engraver. This story is intended to place before the readers of INTERNATIONAL PROJECTIONIST all the available facts relating to this particular enterprise. The wisdom of the International Alliance leaders in forbidding the participation of any I. A. member as a student in such "schools" has been amply demonstrated. It seems a pity that some responsible

[1] "Electrical Apparatus for Reproducing Drawings," by A. Schmid. *Scientific American Supplement.* Nov. 8, 1884, p. 7,371.

From I. A. General Bulletin No. 256

FOLLOWING is a most interesting report filed by the National Better Business Bureau, Inc., of New York, which organization made a thorough investigation of the Projectionist Sound Institute, located at Easton, Pa., and which reveals the inconsistency of the promises and guarantees offered prospective students to secure their enrollment:

Numerous inquiries have been received concerning the Projectionist Sound Institute which is engaged in selling a correspondence course in motion picture sound engineering. The principal of the enterprise appears to be F. A. Jewell. The price of the courses sold by the institution varies. The course itself is said to consist of approximately 52 lessons and to require an average of one year for completion. The institute was founded on or about September 1, 1929, according to Mr. Jewell.

Some months ago we asked Mr. Jewell for certain information which we considered important for the purpose of answering inquiries competently. We wanted to know how many students were enrolled in the institute, and were informed:

"We consider this a personal question and refuse to answer, although we might state that our enrollment is in the hundreds."

Asked the number of instructors, Mr. Jewell replied:

"This is rather an indefinite question and can only be answered in a general manner. Our answer is: A sufficient number of instructors to adequately instruct the number of students we have enrolled."

Advertising for Projectionist Sound Institute has stated that there are "thousands of positions open right now for motion picture sound engineers," has supplemented this with numerical estimates, and has made other allegations regarding the high salaries paid.

In order to obtain what we considered the most competent advice on these subjects, the Bureau consulted the I. A. T. S. E. and M. P. M. O. U. and another authority constituted to represent the producer and theatre owner. Estimates given by these authorities, both as to number of positions open and salaries ordinarily paid were emphatically more conservative than those advertised by the institute. Mr. Jewell was sent this information and his attention was called to the trade practice conference rules adopted by correspondence schools and the Federal Trade Commission. He commented on them as follows:

"We wish to advise you that what you sent us was a Code of Ethics approved by the Federal Trade Commission and is nothing more than just what the name implies—'Code of Ethics,' and not rules or laws. We have legal counsel to whom we pay good money to keep us informed on the legal phase of all our business transactions and we govern ourselves accordingly."

The Projectionist Sound Institute has featured a guarantee to secure employment for any student "providing you will maintain an average of 80 per cent or better in your studies." During April, 1930, a Cleveland resident received a letter from Projectionist Sound Institute, signed W. F. Brittain, part of which read as follows:

"Mr. Lester Al Smith, who is a representative of one of the largest sound equipment manufacturing corporations in the world, has prevailed upon Mr. F. A. Jewell, who is one of the foremost authorities on Sound Projection in the country, and General Manager of the Projectionist Sound Institute, to turn over the facilities of the institute and assist him in selecting a number of men who can be trained to take care of the persistent demand and the vast expansion that his company anticipates."

Subsequently the prospect received a telegram from Mr. Smith urging him to make an appointment. The Cleveland Better Business Bureau reported that Mr. Smith represented himself as being from a certain sound equipment manufacturing company located in New York City and that he told the prospect that upon completing the correspondence course he would be sent to the company named for two weeks' intensive training. We called this to the attention of an official of the company named and were informed that Lester Al Smith was in no way connected with them and that they had no arrangement with Projectionist Sound Institute whereby its graduates would be sent to the company for training.

More recently the institute's literature has represented that, through a tie-up with National Sound Service Bureau and Photo-Electric Research Laboratories, their students can earn while learning and gain practical experience. Letters from National Sound Service Bureau are signed L. A. Smith, Director of Organizations. This organization has informed us that they are an organization of sound equipment and accessories manufacturers, users of sound equipment and sound engineers. We have not received any reply to a request for the names of some of these members. An individual has received a letter from this concern urging him to enroll in Projectionist Sound Institute, and containing the following paragraph:

"If you will send us your enrollment fee for P. S. I., immediately taking advantage of the cash which would enable you to get the lessons as quickly as you could absorb them, we will guarantee to start you in a steady job with us within four months after receipt of your enrollment at a salary of $60.00 per week, but inasmuch as so much rests with you and the time you devote to your studies, we must reserve the right to have the P. S. I. refund your money in full if you do not make good on a job after a fair trial."

Photo-Electric Research Laboratories is located at the same address as National Sound Service Bureau. A letter signed by Herbert Pratt, Director of Sales, tells us that his company is a merchandising organization employing students of Projectionist Sound Institute as agents on a strictly commission basis.

The latest inducement offered by Projectionist Sound Institute that has come to our attention appears to be a "Special Cash Offer" whereby, although the regular price of the course is $120, prospects are told that $100 cash will be accepted in full payment and "This $100 we will reinvest in securing additional members, for which we will pay you 15 per cent of the gross amount received from the members that we secure from the use of your $100." By this system, the prospect is told, he may expect to obtain a return of his original $100 investment plus an additional $20.

NATIONAL BETTER BUSINESS BUREAU, INC.
Commercial Department.

FILM MUTILATION

Abstracts from a report of the Projection Practice Committee of the S.M.P.E.

THE Projection Practice Committee wishes to direct attention to what it considers one of the foremost causes of waste and monetary loss suffered by the motion picture industry, namely, the mutilation of positive prints. This mutilation not only results in a greatly shortened life of the individual print, which is serious enough in itself, but in addition to this, it is impossible to obtain the maximum screen results, which are highly important in creating the proper illusion so necessary to the motion picture play. Both visual and sound results are affected by mutilation of film.

It is generally understood that the mutilation of film is frequently caused through the misadjustment of projector parts, worn projector parts, accumulation of emulsion during projection, excessive oiling of projector or oil leakage, and careless handling of film.

The Projection Practice Committee is of the opinion that there is urgent need for the setting up of standards dealing with the various tensions the film should be subjected to during projection, the clearance of adjacent projector parts and sound apparatus, allowable tolerances, and the degree of wear projector parts may develop without impairing the quality of screen results or causing mutilation of film.

The committee therefore plans to conduct a thorough investigation which will be nationwide in scope with the view of obtaining all necessary data for submission to the Society for the purpose of adopting such standards. In order to accomplish this, the committee requests the earnest cooperation and support of the Society as a whole and also associated individuals and organizations. Their assistance will be needed as this work will be of magnitude and should, when completed, prove invaluable to the industry.

Non-Uniform Processing

The committee wishes to call attention at this time to the lack of uniformity in the processing of prints, which constitutes another serious loss.

In regard to the processing of film, there seems to be no standard for this work at the present time. One producer will use a certain method of processing film; another producer will simply wax the margins of the print, and a third producer will not process the print at all. This condition works a hardship on all concerned, inasmuch as it frequently happens that the producer who has processed his product suffers by reason of the theatre using unprocessed film at the same time. This evil adversely affects both the sound results and the visual picture.

It is well known that with unprocessed film, there is a tendency to accumulate emulsion at the tension points in the projector. Formation of emulsion greatly increases the tension applied to the film and imposes a serious strain on sprocket holes. Occasionally a positive print is irreparably damaged during its first projection.

To Investigate Methods

The Projection Practice Committee recommends that thorough investigation to find the best method of methods of processing film be conducted by some designated committee of the Society so that such methods may be recommended as a standard for the industry. Unless such a standard is adopted, generally accepted, and put into use by the producers of film, the industry will continue to suffer this serious loss now occasioned through faulty (or the absence of), processing methods and such benefits which should accrue through the adoption of the standards relating to projector tensions, adjustments, etc., would be largely nullified.

In the opinion of the Projection Practice Committee, this work is one of the most important contributions that the Society could make to the industry.

Committee Personnel:

Projection Practice Committee: Harry Rubin, Chairman; Thad C. Barrows, G. C. Edwards, Sam Glauber, J. H. Goldberg, Chauncey Greene, Herbert Griffin, Jesse J. Hopkins, Lester Isaac, R. H. McCullough, P. A. McGuire, F. H. Richardson, Max Ruben, H. B. Santee, L. M. Townsend.

The School 'Racket'

(*Continued from preceding page*)

agency for the dissemination of reliable information anent such enterprises is not now functioning, as a prospective student now has no way of determining the worth, or lack of it, of any such set-up. INTERNATIONAL PROJECTIONIST purposes to delve deeply into this matter in an endeavor to supply its readers with information on all such enterprises.

The latest "racket" is the television school, the propaganda of which invariably refers to television being "just around the corner." Projectionists are particularly easy marks for television schools, as there is a natural inclination on the part of the man in the projection room to fortify himself against any contingency. Already many projectionists are enrolled in television schools, and it is likely that there will be many more who will do likewise.

INTERNATIONAL PROJECTIONIST has been offered the advertising of certain television schools but has declined, for the reason that it bears a very definite sense of obligation to its readers and will not be put in the position of seeming to endorse any such institution. It is a very difficult matter to establish whether a given school is worthy or not, and INTERNATIONAL PROJECTIONIST will not accept this responsibility by printing such advertising.

PROJECTIONIST RECALLS WORK WITH EDISON

WHEN the lights in a Brooklyn theatre flashed off on a recent evening—as they did everywhere throughout the country in commemoration of their inventor's death—Louis A. Hammond, chief projectionist, peered into the darkness and let unfold from the cinema of his memory his own association with the great Edison.

There flashed into mind a day 16 years ago when Hammond was chosen from 21 motion picture "operators" to be Edison's assistant in perfecting the synchronization of phonographic recording with motion pictures; chosen, he says modestly, because he "was not afraid to get his hands dirty."

That was in October, 1912, at the laboratories in New Jersey. Less than a year after getting the impressive title of "Chief Operator of Kinetescope and Kinetephone," Hammond was sent to Europe.

The "Hoch Geschenck"

Among the notables before whom Engineer Hammond demonstrated his 12-reel novelty was the Emperor Franz Josef of Austria, who was then 83. The Emperior was so pleased with the performance that he gave Hammond a "double-decker" gold watch, which was the "hoch geschenck," or highest gift, the Emperor could bestow upon a commoner.

"We gave an exhibit in the castle of the Grand Duke and the Duchess of Mecklenberg, and the following night the ancient fortress was burned to the ground. The peasants of the section firmly believe the fire was started from the kinetoscope's celluloid reels and looked upon us as incendiaries."

Investigation proved the fire started in another part of the building from that in which the apparatus was stored and the Hammond party was exonerated. Their machine and the films were destroyed in the fire.

This accident did not, however, end Hammond's association with Edison, for he returned to America and, as he says, "puttered around the Edison Laboratory for more than a year," after which he was detailed to the San Francisco Exposition.

TELEVISION NEWS NOTES

NBC Heads Sees Speedy Television Development

M. H. AYLESWORTH, president of National Broadcasting Company, maintains that television will develop more rapidly than sound broadcasting because it enjoys the benefit of modern research and engineering methods and facilities, as well as the support of the older broadcasting institution. The NBC executive predicts that with television continued as a supplement to existing sound broadcasting, no serious artistic problems are anticipated. When the time arrives that a picture can be transmitted in clear relief, television will be the main issue and sound the supplement. Sports events, parades, ceremonies, plays, pageants and many other subjects can be presented to better advantage than in sound.

Mr. Aylesworth further contends that the immediate application of television is the visual presentation of the broadcast artist. On one set the auditor will hear the song, the speech or the music, and on another set he will see the artist.

Channel Requirments of Good Television

IN televising by radio, the limits are a single channel, and therefore, a single section picture, which could not be projected advantageously upon a motion picture screen. Distant points that can be reached are also very restricted. Even such favorable conditions as will prevail in the instance of the radio vision broadcasts that will soon emanate from the Empire State Building will hardly be heard and seen clearly beyond a 20-mile radius, despite the many objectionable interferences removed because of the height of the sending station.

With such outstanding restrictions, the adaptability of radio televising is automatically confined to motion picture theatres in larger cities until a longer air-wave can be found to bring quality programs to theatres spread throughout the country. In addition, the problem of fading of air transmissions, a puzzle which has not as yet been solved even for the scientifically-built radio sets of today, will have to come in for serious consideration.

Difficult Task to "Sell" Television to Public

WHILE due credit should be given the organizations now actively pioneering in the television market in its infancy, there is no doubt that the widespread introduction of television as a household item awaits the cooperation and use of the vast resources and facilities in back of existing radio and broadcasting systems. The tendency on the part of the larger organizations now working with radio is to maintain a secrecy as to their plans for television. It is generally known, however, that their laboratories are actively engaged in television research, in an effort to produce dependable television products that will put the art into the home on a firm basis.

Much of the interest in television has come from the suggested similarity between the popular science of radio and television. Television has without much effort mustered together an army of enthusiasts from among radio fans, but to "sell" television to the public in general, and enlarge the field to its true possibilities, will undoubtedly require an enormous amount of advertising and far-reaching tie-ups between the closely inter-related organizations that now cater to radio.

Interesting Apparatus of Insuline Corp.

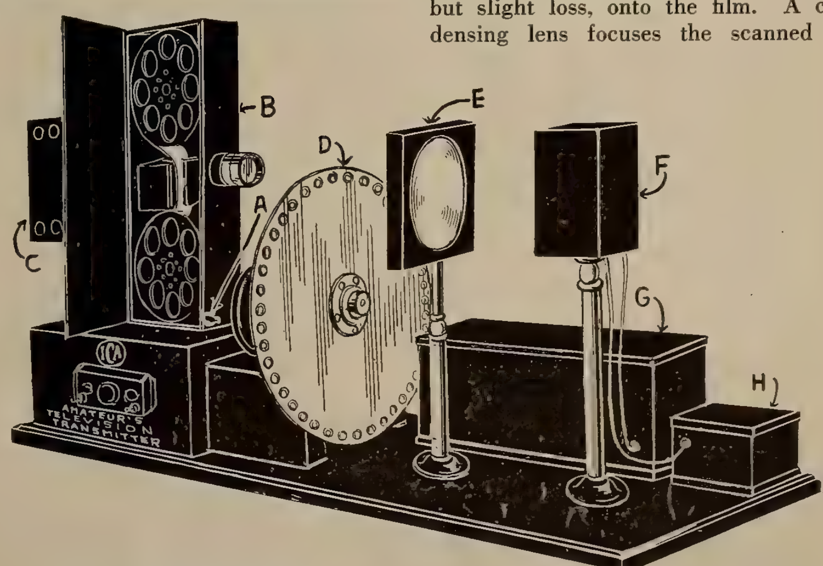
THE apparatus shown in the accompanying illustration is the televisor designed by the Insuline Corp. of America to project television between two points *connected by wire* as transmitted by a single adaptation of a motion picture projector incorporating standard 35 mm. safety film. The transmitter may also be operated in conjunction with a radio transmitter, the picture modulated energy output being used to modulate the carrier-wave in the usual manner.

The method of scanning employed in the transmitter is worthy of special attention. The 16-inch aluminum scanning disc has the holes arranged in a circle for film-picture projection; horizontal scanning, from left to right, is thus accomplished; while the vertical scanning is obtained by the continuous motion of the film in the projector.

Use 24-Hole Disc

The speed of the film downward through the projector must, therefore, bear a definite relation to the speed of the scanning disc. Each "frame" must be scanned from left to right 48 times. Instead of having 48 holes in the disc and revolving it once for each "frame," we have a 24-hole disc and revolve it twice as fast. For a given size of projected picture, this permits the use of a smaller disc than would be necessary if 48 holes were employed.

The photo-electric cell used in conjunction with the transmitter is of sufficient sensitivity to permit its use with a minimum amount of amplification, thus assuring frequency response and a low level of tube and battery noises. Light to actuate the photo-electric cell is obtained from a 500-watt, special ribbon filament Mazda stereopticon lamp. A special optical system of lenses and concave mirrors concentrates the light with but slight loss, onto the film. A condensing lens focuses the scanned di-



INSULINE TELEVISION TRANSMITTER

Front view of transmitter: A, reduction gear driven from rear end of motor shaft; B, reel housing; C, exciter lamp; D, circle-scanner; E, lens (without mask); F, photoelectric cell; G, Television-frequency amplifier; H, phase reverser

verging rays, coming through the scanning disc, onto the photo-electric cell.

Rotation of the transmitting scanner is obtained by mounting it directly on the shaft of a 1/10-h.p. synchronous motor, rotating at 1800 r.p.m. The film is driven by this motor, being connected to it by an eight-to-one reduction gear, thus moving the film at the rate of 15 "frames" per second.

A unique "phase shifter" is also provided to enable positive or negative film to be televised. In this manner, the use of either kind of film is permitted without necessitating the addition or removal of a step of amplification.

New Cathode Ray Tube Great Aid to Art

TELEVISION is expected to take a big step forward with the perfection of the cathode ray tube. The cathode ray tube looks very much like a cone-shaped vacuum bottle, on the flat end of which, on a flourescent screen, images are formed. The images obtainable with the cathode ray tube are considered to be far superior to those produced by scanners or neon tubes. At the same time, the cathode tube can copy a greater number of lines than do the scanners or neon tubes.

In speaking of cathode ray tubes, Sanabria, the 25-year-old television worker who "stole the show" at the recent Radio World's Fair held in New York by televising the largest images so far offered the public, says: "The mechanical method seems best if a large image is desired. The scanning disc and its associated devices are much less complicated than electrical scanning, which calls for expensive and complex apparatus. However, progress is being made with the cathode ray scanner and it shows promise for the future."

The cathode ray accomplishes its work by employing elements which bend the electronic stream back and forth and gives the same effect as scanning. The cathode ray cannot, however, be incorporated in the ordinary receiver without the use of special equipment that will allow but an extremely small amount of current to pass at a high voltage.

The New York Television Demonstration

THE recent television demonstration by U. A. Sanabria, 26-year-old Chicago "wizard," at the Broadway Theatre in New York City, has set to wagging the tongues which for several years past have been predicting "television just around the corner." Many of our readers have expressed interest in this demonstration and have inquired as to its significance. The answer is that the demonstration is significant only in that it generated not a little worthwhile interest in the television art—and that is all. Technically, the week's run was just so so.

It would be idle to deny that much progress has been made and is daily being made in the television art. But just at present there is nothing to indicate that television will soon enjoy any great degree of popularity. Its use in the theatre still is a matter of years and not days, weeks, or months, as is predicted by many television promoters.

The Sanabria demonstration was nothing more or less than conventional. True, he did produce a 9-foot picture but only at a great sacrifice of detail. We saw the picture and it wasn't any great shakes. We haven't seen a larger picture anywhere, but we have seen much better quality—which, after all, is what counts. The Sanabria picture required much squinting and peering to distinguish the image, and it proved a dull show to us.

That which Sanabria gave us at the Broadway could have been done by any number of television workers. Jenkins, Western Electric, Radio Corporation of America and one or two others we could mention could have done as well, if not better. The answer to the question of "Why don't they?" is that these companies are working for quality images and not quantity. Mr. Sanabria got his 9-foot picture all right, but in so doing he sacrificed quality—that is, the sort of quality to which we are accustomed.

The best television we have seen thus far has been that of Bell Telephone Laboratories, and this particular system, according to the Laboratories' own admission, is far from being a commercial possibility. We had a "commercial" television set in our home for several weeks, but the images were so poor that we gladly loaned the set to a friend and were glad to be rid of it.

To those projectionists who are anxious about the early arrival of television in the theatre we say "Forget it." It is all very well to maintain a lively interest in the progress of the art, but getting excited about "television just around the corner" is a waste of energy. There is nothing to it.

JAMES J. FINN

Suggests Multi-Screen for Four Televised Images

WRITING in the current issue of *Television News,* C. Maggi suggests a multi-screen receiver that will, by projecting images on four sides of the cabinet, permit observers to see television images not only from the single position straight in line with the lens, but from four (or more), angles. The essential parts needed to build a multi-screen receiver are: four scanning discs, four neon tubes, four screen assemblies, one upright motor, and five gears.

In assembling the multi-screen receiver, the motor is mounted to the baseboard. The master gear is mounted at the end of the motor shaft, and four gears are mounted about the master gear (90 degrees from each other) with a ¼-inch shaft 7 inches long. One end of the shaft goes to the scanning disc and the other to the scanning gear, which is revolved by the master gear. The four scanning shafts are supported by a four-sided frame, with its associated collars, etc.

Complete details and drawings for building the multi-screen receiver are contained in the Maggi article, which is recommended to television "fans."

VACUUM TUBE PRODUCTION

The production of a vacuum tube parallels a tremendous industrial task, in miniature. Aside from the numerous fine elements used in the construction of a tube which could be termed analagous to minute girders, braces, cross-members, etc., there are 186 various spot welds in the final assembly of the elements.

This is equivalent to the number of welds required in laying a ¾-mile pipe line, with each section of pipe 20 feet long. This would be sufficient to weld all steam and water pipe connections in the average home; or, in the marine field, to weld a mammoth anchor chain 93 feet long for one of the big ocean liners. In aviation, a complete plane including the frame and fuselage could be securely welded with this large number of operations.

It is hardly believable that this great number of welds are necessary in a small article like a vacuum tube. But fine wire and small parts are used which require a weld no larger than a pin-head.

H. & C. NEW H.-I. LAMP

Hall & Connolly, Inc., have developed a new and radically different high intensity projection lamp for amperages from 75 to 200, the result of intensive research for more than a year. The design for the lamp includes a number of new principles that will appreciably improve projection and facilitate operation.

The PATENT PAGE

Edited by H.L.Burkitt

THE following digest of patents granted recently was prepared exclusively for INTERNATIONAL PROJECTIONIST by Henry L. Burkitt. Mr. Burkitt, B.S. in ch. e., L.L.B., is a former Assistant Examiner in the U. S. Patent Office, a member of the Bars of New York, Pennsylvania, and the District of Columbia, practicing in New York City. Any reader desiring information on any patent, whether abstracted herein or not, should address Mr. Burkitt in care of this publication.—*Editor.*

Granted September 8, 1931:

Film Projector

1,821,930. *Cinematographic Projector, to Maurice Couade.*

The film guide of this patent apparently is associated directly with means for advancing the film intermittently. A member, which reciprocates both in the same line as the film moves, and toward and away from the film, has a claw intended to be projected through the guide to engage the film and move along with it, and then to be withdrawn from the film. An eccentric pin produces the two reciprocatory movements of the claw member.

Film Mechanism

1,821,946. *Motion Picture Apparatus, to Freeman Owens.*

A motion picture projector, using sound film, has a shutter shaft with a combined drive wheel and shutter affixed adjacent to its end. A frictional device engages the drive wheel to transmit power to the shutter and to the mechanism for intermittently moving the film. A finger wheel at the end of the shaft opposite the drive wheel provides means for rotating the shaft.

Novel Recorder

1,822,057. *Method for Recording Photographic Sound Records, to Freeman H. Owens.*

The invention is concerned with the consolidation, upon a single film, of the musical or other sound effects recorded individually upon a plurality of films. The electrical impulses, created by a number of such films, are used conjointly and simultaneously to modulate the intensity of a light producing element. The varying light from this element is then used for recording on the single film.

Plurality of Lenses

1,822,528. *Moving Lens Cinematograph Machine to Wesley Ernest John.*

A number of lenses are moved past a point at which they are exposed. The lenses are arranged to move along straight and curved paths, these paths communicating so as to form a continuous path.

Recording Light Source

1,822,865. *Method and Apparatus for Producing Photographic Records, to T. W. Case.*

The patent is for a light source used in making sound films. Its particular structure would probably be interesting only to those working in this highly specialized field.

. . . not "clips" in wordy patent language but clear and concise abstracts prepared especially to meet the needs of readers of this publication.

New Perforating System

1,822,350. *Arrangement of Perforations Cinematographic Films, to Julien Henri Jarnier.*

The film of this system has its perforations between the images, rather than along the sides, as is customary in America. The number of perforations is determined according to a formula in which the number is made directly proportional to the width of the film, and to a factor called the specific resistance to rupture by traction, and inversely proportional to the difference between the resistance to rupture of the width of a perforation and the product of that width and the specific resistance to rupture.

Lens Shifting Device

1,822,551. *Lens Shifting Mechanism for Projecting Machines, to Albert Tondreau; assigned to Warner Bros. Pictures, Inc.*

This patent relates to a means for positioning one of a number of lenses with relation to a motion head. The arrangement of the lens shells permits longitudinal adjustment of the shells with relation to each other. A pivotal connection permits any one of the shells to be positioned with its axis in alignment with the projected light. The lens shifter handle is provided with suitable stops for defining its movement.

Film Control

1,822,727. *Film Phonograph, to Guillermo A. del Valle; assigned to General Electric Company.*

In connection with a sound record made on a film, means are provided at the end of the sound track to be engaged by a member normally out of engagement, but moving into engagement with the film when the roll of film has decreased to a predetermined diameter. This means could be used for stopping the motor or for any other purpose.

Granted September 15:

Film Winding Device

1,823,245. *Motion Picture Film Winding Device, to Otto Wittel; assigned to Eastman Kohak Company.*

This winding device includes a flange and a pair of hubs, one of which is slidably carried by the flange. The hub members are separable by sliding the flange on one of them.

Tinting Sound Film

1,823,246. *Method of Tinting Films for Use in Sound Reproduction, to Albert A. Young; assigned to Eastman Kodak Company.*

The sound track portion of the film is preserved untinted while the remainder is retained against shrinkage. A dye, dissolved in a medium consisiting of two solvents, one both for the film and for the dye, and the other not dissolving the film. The latter acts to reduce the evaporation rate of the entire solvent, and thereby reduces the tendency of the film to buckle.

Modifying Sound Negative

1,823,349. *Sound Picture System, to Shelby C. Chapman; assigned to Electrical Research Products, Inc.*

The patent is for a method of modifying the negative of a sound film and involves chemical reduction of the sound record, progressively varying lengthwise of the film.

Framing Device

1,823,355. *Telescope Framing Device, to Louis Simon Frappier and Ewald Boecking; assigned to International Projector Corporation.*

A microscopic adjustment is provided for light directed upon sound film. The microscope used for this adjustment is supported in a housing at an aperture, adjacent which is located a prism supporting means for changing the angle of the scanning light. The housing may be mounted upon the film gate support in interchangeable relation with the film gate itself.

Novel Speaker Diaphragm

1,823,512. *Loud Speaker, to Abraham Ringel; assigned to Radio Corporation of America.*

A loud speaker includes a diaphragm so small that it would not normally reproduce low frequency notes. A method is involved in which a diaphragm of this character is used and the movement of the driving member for the diaphragm is stepped up sufficiently to reproduce the desired low notes.

Disc Reproducer

1,823,737. *Motion Picture-Sound Apparatus, to Charles L. Heisler; assigned to General Electric Company.*

This projector includes a phonograph turntable, mounted on the same base with the projector and having separate adjustment on a common axis. A motor is provided and has a drive connection with the turntable.

Granted September 22:

Film Matching Means

1,824,294. *Sound and Picture Film Matching Means, to Freeman H. Owens; assigned to Owens Development Corporation.*

Sound film, to be used for reproduction synchronously with a separate picture film, has on a

portion thereof parts of the picture film so that the operator will be enabled to match the two films in reproduction.

Multi-Element Screen

1,824,353. *Screen for Showing Projected Images in Lighted Rooms and for Short-Exposure Photography, to Rasmus Olaf Jonas Jensen.*

A screen consists of a member of light refracting material, one surface of which presents to the image source a multiplicity of lenticular elements. Each of the elements focuses upon its opposite surface the light received. This surface is translucent only at these foci and is light absorbent at all other points.

Color Photography

1,824,446. *Method of and Apparatus for Producing Motion Pictures in Color, to Edwin L. Pearson.*

A projection machine produces colored motion pictures by successively projecting images through different color filters, the colored images being projected upon a screen having various colored sections corresponding to the filters. The relative positions of projector and screen are shifted to project images successively upon portions of the screen corresponding to the particular filters through which particular images were produced.

Photo-Electric Cell

1,824,573. *Photo-Electric Tube, to Fritz Schröter; assigned to Gesellschaft für Drahtlose Telegraphie m. b. H.*

This photo-electric cell has a light sensitive cathode formed of an alkali metal to which a very small portion of caesium has been added to accentuate the photo-electric effect and to raise the critical potential at which glow discharge starts.

September 29, 1931:

Film Magazine

1,825,142. *Motion Picture Film Magazine, to William A. Bruno; assigned to Clarence W. Fuller.*

The drive for the film is constituted by a film reel having a plurality of spaced openings on the film carrying surface. A propelling drum is mounted within the reel and has a plurality of teeth which simultaneously engage in the openings in the reel and the openings in the film carried by the reel.

Overlapping Film Reel

1,825,438, 1,825,439 and 1,825,440. *Photo Sound Recording or Reproducing, and Sound Recording or Reproducing Apparatus, to Aloysius J. Cawley; assigned to Radio Corporation of America.*

These patents relate to sound film. A reel carries the film with the sound records at its edge. The wheel is on such extent that the sound extends beyond the edge of the wheel to permit proper transmission of light therethrough.

Driving Mechanism

1,825,442. *Driving Device Employing Maltese Cross Wheels, to Marius Chambon; assigned to Etablissements L. Chambon.*

The mechanical movement in this patent for securing intermittent motion has a Geneva gear mounted on the driven shaft, and a plate on the drive shaft. The plate has a sliding member carrying a roller engaging the Geneva gear, and a cam, parallel to the plate, is engaged by another roller on the member.

Granted October 6:

Reel and Spindle

1,825,663. *Film Reel and Spindle, to Arthur C. Hayden.*

The reel is made up of a pair of plates, held separated by a hub on which the film is wound. Both plates have openings formed therethrough, and one of them has tongues projecting into its opening to cooperate with a groove in a spindle extending through both openings to prevent movement of the reel axially of the spindle.

Color Photography

1,825,863. *Color Photography, to Joseph B. Harris, Jr.*

The invention relates to the production of color potographs by first forming images on a layer of ligth sensitive material carried by a transparent member. Images are formed on the two faces of the material, that is, the exposed face and the face adjacent the transparent carrier. Then the outside image is developed and toned with ferric (compound of iron), salts after which this image is resensitized. Then the other image is developed and toned.

Continuous Projection

1,825,953. *Device for Permitting the Continuous Feeding of the Film in Projecting Apparatus, to Per Georg Halvar Hallongren.*

The apparatus is for projecting moving pictures without the customary intermittent stopping of the film. Two sets of mirrors are arranged radially upon two separate axes. These sets are rotated synchronously in the same direction. The reflecting surfaces in each group face in the same peripheral direction. The reflecting surfaces of one group face in the direction of rotation, while the reflecting surfaces of the other group face in the opposite direction. Light striking a mirror of one group is reflected to a mirror in the second group, provided, of course, the mirrors are in position. Since mirrors are continuously rotating as the film moves, the same interruption occurs as with a shutter and an intermittingly moving film.

Color Process

1,826,001. *Color Photography to John Naish Goldsmith and Thomas Thorne Baker; assigned to Spicers, Ltd.*

The film consists of a cellulose derivative, the film base, first coated with a material reacting against the penetration of dye solutions and discharging agents into the base. A layer, which will take dyes and discharging agents, is applied then. Finally, a multicolor screen is applied.

The essential conditions for producing pictures in stereoscopic relief are two: first, separate pictures must be made from different points of view, corresponding to the two eyes; second, each eye of the observer must receive its appropriate view. No compromise with these fundamental requirements appears possible.

Dr. Herbert E. Ives
Director, Electro-Optical Research
Bell Telephone Laboratories

Plurality of Cells

1,826,522. *Apparatus and Method for Reproducing Photographic Sound Records, to Freeman H. Owens; assigned to Owens Development Corporation.*

Light from the light source is directed through a sound film and impinges either upon a light cell, immediately aligned with the film and the light source, or upon mirrors or like light diverting means directing the rays upon one or more other light cells. All of the impulses in the individual light calls are jointly amplified and rendered audible.

Granted October 13:

Sound Picture "Stills"

1,826,786. *Method and Apparatus for Reproducing Sound in Connection With Pictures, to Philip S. Hopkins; assigned to Agfa Ansco Corporation.*

The apparatus of this patent is designed to coordinate the use of a sound film with "still" pictures, that is, the mechanism coordinates the showing of such pictures with the reproduction of appropriate parts of a sound record.

Film Printer

1,826,858. *Photographic Printing Apparatus, to Vladimir K. Zworykin; assigned to Westinghouse Electric and Manufacturing Co.*

The apparatus is designed for transposing the record of one film upon another film, and apparently is intended to produce a picture of a different size or having different characteristics than the old film. The driving mechanism for the two films ave different effective speed producing portions. The driving portion for one film is within the driving portion for the other film, and light from the negative is transmitted through the space between the two driving portions.

Fire Preventive

1,827,010. *Film Flame Stop, to Lawrence D. Kohlmeyer.*

A frame is provided carrying a number of rollers, other frames being mounted to permit the rollers, by gravity, to swing downwardly toward, and to be stopped tangentially against, others of the rollers, apparently to grip and stop the film and to retain it against feeding where a fire has started and also to prevent burning back.

Film Drive

1,827,588. *Film Drive, to Edward W. Kellogg; assigned to General Electric Co.*

The film is driven by a sprocket and a drum, and means are provided, responsive to difference in speed of the portions of film moved by the respective sprocket and drum members, as determined by the number of sprocket teeth openings, and independently of the length of film between the members.

Screen Cabinet

1,827,598. *Moving Picture Cabinet, to Arthur Merriman.*

This patent is curious merely in that it includes, with a cabinet designed to direct a cinematic beam outwardly through an opening in one of its walls, a screen external of the housing and supported upon a framework so that both framework and screen may be folded into a substantially horizontal plane and slid into a compartment in the cabinet.

1,820,054. *Light Guard for Motion*

Projector Light Guard

Picture Projection Machines, to Augusto Dina; assigned to International Projector Corporation.

The apparatus of this patent is to limit the area of the light beam falling upon the sound track.

NOTES *from the* SUPPLY FIELD

★

GOLDE 3-ALARM A VALUABLE PROJECTION AID

DESPITE the adoption of the Standard Release Print, with its uniform cue and footage markings, there still are projectionists who find it necessary to add their own cues to the film. The S.R.P. was designed to eliminate such marking, and it cannot be denied that the trouble from this source has been reduced. However, the presence on film of individual markings—foil contacts, scratches, punchings, chalk marks, clicker patches, and even scraped frames—shows that the S.R.P. did not solve the change-over problem for projectionists.

It is generally held that the principal reason for adding extraneous markings to film is fear—fear that the dots have been missed or that some unforseen development will arise just before the cue markings appear. This anxiety on the part of the projectionist to maintain perfect continuity causes him to introduce visible or audible signals—which help him but greatly distract the audience. Patrons resent such interruptions, and their resentment is reflected at the box office.

Aside from the human equation already mentioned, there is the matter of variation in motor speed to be considered. Some projectors require several seconds more than others to come up to speed, and no standard markings can guide the projectionist as to when to start the incoming projector. Then there is another angle and this the fact that projectionists cannot be "standardized": one man's reflexes may be slower than those of another. There are also the censor's scissors which may have shortened the distance between cue marks or eliminated them.

To guard against such contingencies many projectionists place marks at varying distances from the change-over cue. Such marks introduce another hazard, for the projectionist who receives a film bearing the marks of five or six earlier showings, finds it almost impossible to pick out his own swiftly-moving marks, and is likely to come to the cue with a slow machine.

Mutilation Rampant

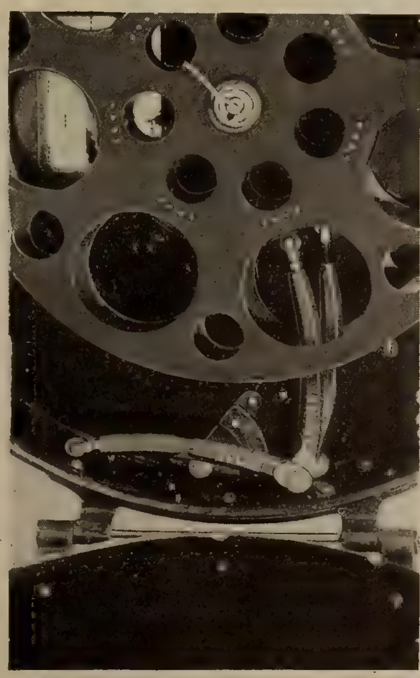
These are some of the things which theoretically should not affect operation but which in practice often produce very bad results. Incidentally, it is a known fact that exchanges make a practice of shipping old and worn film to theatres which persistently return prints bearing damaging marks. This is done not in retaliation but as a matter of economy. To send a new unscratched print to such a theatre results in complaints from subsequent-run theatres. Projectionists should establishe a reputation at the exchange for careful film handling, as this will insure receipt of better prints.

Throughout this country there are many personally made devices for giving a change-over warning, but without exception such devices scratch or wear the film. If these devices were replaced by one which causes no abrasion of film and at the same time renders all markings unnecessary (even to the extent of reducing the size and number of S.R.P. markings), great benefit would accrue to the projectionist as an individual and to the exhibition end of the industry.

Plainly, what is needed is a device that will tell the projectionist when to illuminate his arc, when to start his motor, and when to throw his change-over shutter. These three signals *must* be given in a manner that the projectionist cannot miss or mistake, no matter what may tend to distract him, and in a manner that will not distract the audience. The signals must be so timed as to suit the acceleration of the machine and provide for the reactions of the individual projectionist.

Solving the Problem

A device that meets all these requirements has recently been adopted by some of the country's leading theatres, and long tests therein have proven its worth and given indication that its use will soon be widespread in those theatres who desire flawless projection. This device is the GoldE 3-Alarm.



The GoldE 3-Alarm

As is shown in the accompanying illustration, this device has three arms pivoted at one end, the free ends each carrying a roller. The pivot is mounted on the movable end of a bearing plate, which is also pivoted. The movement of this bearing plate is limited by a spring locking pin. The bearing plate pivot is held by a base plate securely fastened to the wall of the magazine. The roller on the free end of each arm may be micrometrically adjusted to greater or less distance from the pivot—in effect, shortening or lengthening the arm. This adjustment may be permanently set by means of a nut lock.

The rollers ride on the diminishing roll of film in the upper magazine. One arm is adjusted to fall off the roll when it has so diminished that the change-over cue is *one minute away*. The second arm falls at a time determined by the projectionist but far enough ahead of the change-over cue to allow him to bring his incoming machine up to speed. The third arm falls as the change-over cue arrives on the screen. As each arm falls it clicks against the magazine, giving a sound that is clearly audible above the whirring of the projector but which cannot be heard outside the projection room. Thus the projectionist is not required to watch the screen—his eyes can aid his hands in making a smooth change, and no signals are necessary in either the frame or sound track. The audience is, of course, wholly unaware of the change.

Projectionists reading this will immediately reason that, to operate the GoldE 3-Alarm successfully, reel hub diameters must be exactly uniform. That thought is correct. Two diameters are in general use: 5-in. and that of 2-in. Mention was previously made of a pivoted bearing plate limited in its movement. The inner limit of this plate adjusts all three arms of the 3-Alarm for a 2-inch hub; the outer limit sets them for a 5-inch hub. Thus the two standard hub diameters are provided for.

There are off-standard hubs, of course, but these are in the minority. They may be used, however, by employing a method of building up the hubs to standard diameter which has been developed by for use with the 3-Alarm: to discover off-standard hubs, cut a length of film the ends of which will exactly butt together when it is wrapped once around a standard hub and test all hubs with this.

Varying Terminal Lengths

It will also be discovered that to make the 3-Alarm practicable, the distance from change-over cue to the end of the film must be alike in all reels. A check of more than 100 reels as they were shipped from exchange has shown that the number of reels in which this distance is incorrect is so small as to be negligible. Those that do vary are seldom more than 1 or 2 feet, which is well within the limit which makes the 3-Alarm accurate. The rare cases of exceptional variation in either shortness or

length are easily detected. As every projectionist inspects all film on its arrival from the exchange, a very simple check for length may be made at that time.

With the film reversed on the rewind, strip off as far as the change-over cue (or the end of the action). Then count the number of turns of the rewind handle from the cue to the end of the film. If the variation is 1 turn, or a fraction thereof, the performance of the 3-Alarm will be accurate. If variations of greater than ½ turn either way are found, cutting or patching the tail end will equalize them.

When the 3-Alarm method of change-over preparation has become general, it is likely that producers and exchanges will provide all prints with standard terminal lengths. It is to be expected that such action will not be delayed, as the GoldE 3-Alarm appears to supply the answer to a positive, complete and inexpensive change-over signal.

NEW G.E. THYRATRON THEATRE LIGHTING CONTROL

THYRATRON tubes are the basis of the new G.E. lighting control scheme. By shifting the phase relationship between the elements in the tube, the average amount of rectified current passed by the tubes is varied, governing the intensity of the lights. By splitting the lights into various circuits, various groups can be controlled individually, and related groups of circuits can be controlled collectively through master circuits. This lighting control scheme eliminates the bulky back-stage switchboard and makes the manipulation of the control a matter of extreme simplicity. A modified form was installed in the new Earl Carroll Theatre in New York, just opened; and RKO, in addition to a new Schenectady theatre, will install the system in new theatres in Albany, N. Y., and Denver, Col.

The new Schenectady theatre, being designed for the production of motion pictures only, has but 10 major lighting circuits, 6 on the stage and 4 in the auditorium. The stage lights are divided into three colors: white, red and blue, with one control for each color in the footlights and borders. In the auditorium but one color is used, with a circuit control for the fixtures, two for the ceiling and another for the niches and receptacles. A novel addition to the lighting scheme is a "panic" control by means of which the full brilliance of all the lights in the theatre can be turned on instantly by the flick of a single switch, no matter what complex lighting effects might be in progress at the time.

SPECIAL W.E. EQUIPMENT FOR STAGE PLAY

ANOTHER innovation for legitimate stage productions has been contributed by Electrical Research Products, Inc., with the opening in New York of "Hamlet." Shakespeare's century-old lines will be enhanced by modern science in the form of music and sound effects coming from the loud speakers of a W. E. music reproduction system.

Discs Lose Favor

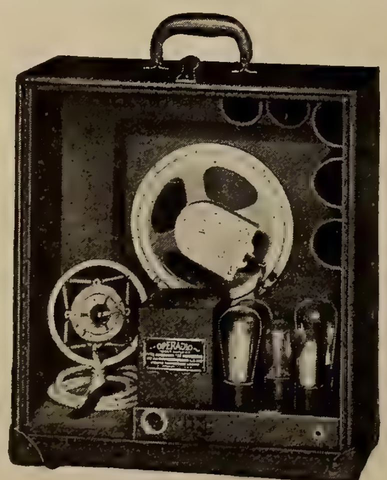
The rapid decline of discs as accessories of sound reproduction in the theatre is emphasized by a recent survey of Western Electric domestic installations. Of a total of 5,300 such installations there are only 5 equipments which hande discs only. These equipments which are capable of handling only sound-on-firm number 1,500; with the balance of 3,795 equipments able to handle either disc or sound-on-film transcriptions.

These figures provide an interesting sidelight on the progress made in the art since the first sound picture was exhibited in 1926. Economic considerations are reported to have played the leading role in the displacement of disc recordings by sound-on-film, inasmuch as many experts in sound recording maintain that discs afford a better quality of recording and reproduction.

Special recordings have been made of a type similar to those used for electrical transcription programs broadcast over the radio. Twin turntables, operating at 33 1/3 revolutions per minute, are so arranged that there is no pause in switching from one record to the next, and also provide for superimposing one sound effect upon another. This superimposing facility is used to particularly marked advantage in the ghost scene, during which the weird sound of the wind at midnight continues through a brief musical selection which heralds the appearance of the ghost.

The sound from the "phonograph records" is reproduced through five loud speakers located at various positions back-stage and controlled by a switching system which permits selective or simultaneous operation. Thus, in the mob scene, by switching from one speaker to another in sequence the sound gives the illusion of a crowd surrounding and approaching the citadel, and the weak, far-off murmurs and cries develop to a great climax and loud cheers when the gate is finally broken down.

The prelude, overture, and entire musical accompaniment to the show is reproduced over the system—there being no orchestra or other conventional music used in connection with the play.



Operadio Portable Reproducer

OPERADIO PORTABLE PUBLIC ADDRESS SYSTEM

THE Operadio Mfg. Co. has added to their line of large public address equipment a portable public address system. The complete unit is carried in a single carrying case and complete with tubes, microphone and all accessories, the weight is only forty pounds.

The input from the two-buttom microphone that is supplied, or from any 200-ohm phonograph pick-up, is raised by the three-stage amplifier to a volume level sufficient for addressing a group of people that may be assembled in a room 1,000 feet square. The amplifier operates from 110 volts, 60 cycle, A. C., and supplies power for all accessories including the dynamic speaker and two-buttom microphone.

A control panel is provided with separate volume controls for microphone and phonograph input, and a change-over switch for shifting the amplifier to either input. The cover provides stowage for a 50-foot rubber covered microphone lead and a 25-foot A. C. line cord. A jack is provided that allows from one to four additional A. C. dynamic or magnetic speakers to be operated without affecting the output of the main speaker.

BRITISH 16 MM. SOUND FILM REPRODUCER

The British Thomson-Houston Co. will turn out a reproducing set for 16 mm. film, which was demonstrated at the recent London Radio Show. A machine has been designed and is in use for reducing full-sized film to 16 mm., and it also reduces the sound track in the process. Printing is done from a 35 mm. negative straight on to the miniature positives. The reproducer set weighs only 60 pounds, with dimensions of 24 in. by 18 in. by 8 in. The price, not yet fixed is expected to be under $1,500.

NEW ERPI DIVISION HEADS

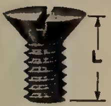
The appointment of E. S. Gregg as General Manager of the Eastern Division, and of H. W. Dodge as General Manager of the Central Division, has been announced by Electrical Research Products, effective immediately. Gregg recently returned from England, where he served as Managing Director of Western Electric Co., Ltd. Dodge has been Sales Manager of the Central Division for several months, and before that was Merchandising Manager in New York.

MECHANICAL HINTS

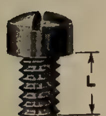
Types of Machine Screws

A description of the styles of machine screw heads and the method of measuring lengths as indicated by the distances between the arrows:

Round Head Screws have a semi-elliptical shaped head.



Flat Head Screws have a head with a flat top and a countersunk angle of 82°.



Fillister Head Screws have a rounded surface for the top of the head, the remainder being cylindrical.

Oval Countersunk Head or *French Head Screws* have a rounded surface for the top of the head and a countersunk angle of 82°.

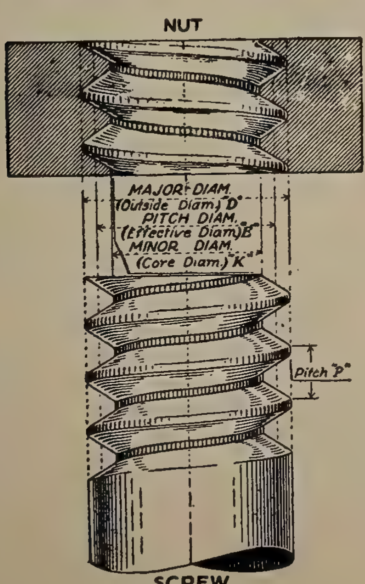
Oval Binding Head Screws have a head similar to Standard Round Head Screws with the exception that the height of the head is less.

Flat Top Binding Head Screws have a head with a flat top and straight side. The height of the head is less and the diameter greater than that of Standard Fillister Head Screws.

Screws Types of

Standard Screw Thread Nomenclature

The following terms have been adopted as American standard screw thread nomeclature, and are recognized as such.



Major Diameter. The largest diameter of a screw thread. The term "major diameter" replaces the term "outside diameter" as applied to the thread of a nut.

Minor Diameter. The smallest diameter of a screw thread. The term "minor diameter" replaces the terms "core diameter" and "root diameter" as applied to the thread of a screw and also the term "inside diameter" as applied to the thread of a nut.

Pitch Diameter. On a straight screw thread the diameter of an imaginary cylinder the surface of which would pass through the threads at such points as to make equal the width of the spaces cut by the surface of the cylinder.

Pitch. The distance from a point on a screw thread to a corresponding point on the next thread measured parallel to the axis.

Practical Hints on Assorted Jobs

Varying Speed Motor. A motor in which the speed varies with the load, ordinarily decreasing as the load increases—for example, a series motor, compound motor, or series shunt motor—is called a varying speed motor. An induction motor with a high resistance rotor is also a varrying speed motor.

Variable Speed Motor. A variable speed motor is one which can be operated at various speeds, and is usually under control at all times. Railway motors, crane motors and hoist motors are often of this type. Wound rotor induction motors are variable speed motors, and, with proper control equipment, any direct current motor may be a variable speed machine.

Reaming Holes. A rat tail file makes a good reamer in an emergency. Put the file into a bit brace and operate the brace backwards.

Soldering Ladle. A three-eighths-inch gas cap with a handle on it makes a valuable solder ladle for soldering in close places.

Wood Screws. In driving wood screws into hard wood a lubricant makes the job easier. A little machine oil, axle grease, or yellow soap on the thread of the screw saves the strength and patience of the mechanic. Linemen will have the twisting off of lag screw heads by using one of these lubricants.

Oil Rings. A substitute for a metal oil ring for bearings can be made by using a piece of stout window cord neatly spliced to the proper size. The cord will soak oil and distribute it to the bearing top efficiently.

Projectionists everywhere have acclaimed the superior qualities of INTERNATIONAL PROJECTIONIST as a craft publication. The unprecedented support accorded INTERNATIONAL PROJECTIONIST before publication was proven by the first issue to have been warranted. Subscription progress in the few weeks which have elapsed since publication of the first issue is outlined below, and the details are significant in pointing the way for the progressive projectionist. INTERNATIONAL PROJECTIONIST is an indispensable necessity in and out of the projection room. Your brother craftsman who is a subscriber will tell you that you cannot be without it.

INTERNATIONAL PROJECTIONIST

Edited by James J. Finn

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NOTES ON THE S. M. P. E. PROGRESS REPORT

INTEREST in the adoption of wide film, though dormant for the past six months, is expected to be aroused again with the return of normal economic conditions. The high speed panchromative emulsions introduced earlier in the year have been given exhaustive trial under the severe working conditions prevailing in the studios, both in this country and abroad. General satisfaction has been expressed by the trade on their characteristics. Huse has described a panchromatic film which has the emulsion coated on a support having a neutral gray density of 0.2 which is claimed to minimize trouble from halation.

Studio and Location. During the last six months, motion picture studios continued to make their sound recording equipment more portable and to bring the talking picture gradually to the same technical perfection as the old silent picture.

Studio Illumination. Very few new new pieces of illumination equipment were introduced in American studios. An addition to the cast silicon-aluminum equipment announced in the previous report is a new spotlight employing a 2,000-watt, 115-volt monoplane filament lamp.

Sound Recording. Maxfield has shown tht an empirical relationship exists between the placement of camera and microphone, and the acoustic properties of the set. Some eight or ten pictures have been made using the technic, and the results were so well-liked that a more general application of the principles is being made.

With a new intensity meter, it is possible to measure sound and noise intensities in sound stages and theatres. Levels from 15 to 100 decibels above the hearing threshold may be measured. The instrument is characterized by its compactness and lightness of weight.

Satisfactory recording of frequencies up to 10,000 per second is claimed for the Fidelytone system of sound recording developed in England. An image of the cathode consisting of a long metal strip in an exhausted glass tube is formed on the moving film, the light glow extending along the length of the cathode from the metal anode opposite its center point. The length of the glow varies in accordance with the modulated input of the tube.

According to a report from Hollywood, a new dynamic microphone has been introduced which has an essentially flat response from 50 to 10,000 c.p.s. The Metro-Goldwyn-Mayer studio have accomplished an innovation by placing the microphone and associated amplifier in a spherical metal housing.

Poor Processing

Laboratory Practice. Laboratory processing of negatives and master prints is quite satisfactory but evidence exists that much of this quality is lost in the preparation of release prints, on which the public judges the value of the entertainment of a picture. Recommedations are being drawn up to correct this serious production defect.

Standard Kine Laboratories in England have installed apparatus for working the Hepworth "stretched" negative process. Films taken at 16 pictures per second can be "lengthened" and subsequently projected at higher speeds. It is claimed that "slow motion" films can be made by this method from normal negatives.

Projection Equipment and Practice. Unperforated Czaphane film was projecte on a Cinelux projector at a meeting of the French Société de Photographie held this summer. Although the facilities did not permit reproduction of the recorded sound, it was reported that the demonstration otherwise was successful. Framing of the unperforated film was accomplished by projecting light through images of perforations (printed along one side), onto a selenium cell connected to a one tube amplifier. Splicing is accomplished by treating the surface with a normal zinc chloride solution at a temperature of 140° F.

Sound Picture Projection. While there has been some improvement in the quality of reproduced sound in the better type of theatre, during the past year there has been no radical improvement in the devices or in the method of reproduction. Very slight improvement, if any, has been noted in the quality of

reproduced sound in the smaller theatres.

A lamp for slitless sound reproduction has been devised by Dunoyer. Essentially the lamp consists of a cylindrical glass bulb having a flat piece of optical glass sealed in one end exactly parallel with a tungsten filament 25 mm. long and 0.1 mm. diameter. The filament is made in such a way as to be perfectly rectilinear at its normal temperature of 2290°K. The image of the filament falls on a triplet anastigmat lens which at a magnification of 8 gives a scanning zone of 3 mm. length by 0.0125 mm. width.

Non-Intermittent Projection. A non-intermittent projector for very thin (cellophane) film was demonstrated successfully in Madrid, Spain. The film has a row of perforation along one side and the sound track is printed along the other border. Since the film moves continuously, the sound record does not have to be displaced from the picture but runs alongside each picture.

Screens. A new sound screen recently demonstrated in London consists of a special fabric upon which small semi-parabolic lenses ⅜-inch in diameter are mounted with a special light reflecting cement. The spaces between the lenses are cut away. A screen 22 ft. by 17 ft. carries about 460,000 lenses.

In a new type of reverberation meter supplied by Electrical Research Products, Inc., sound energy is converted to electrical energy and a series of points are recorded on a waxed paper drum which give graphically the exact history of the sound decay.

Television Systems. Short has published details on a television direct pick-up camera, in which the image of the person being televised is focused directly upon spiral number one of the scanning disc. The camera is mounted on a rubber-tired truck which runs under its own power. Detailed movement of baseball games, tennis matches, and airplanes in flight have been followed easily with the apparatus, and it is possible to move quickly from a "close-up" to a "long-shot."

At the end of each scanning cycle in the Barthélemy system, the beam is interrupted a very short time. These lapses produce a 480-cycle frequency, which, filtered by an ingenious amplifying circuit, is used to operate a synchronous motor which drives the receiving scanning disc. A 3-watt lamp is used for a picture area of 600 sq. cm., as opposed to a 250-watt lamp for a 6 sq. cm. area in certain other systems.

Color Cinematography. A new additive screen process of three-color cinematography was demonstrated successfully before the Royal Photographic Society in May, 1931. The manufacture of the film has been described by Periera, who states that 1,000-foot lengths of aceto-cellulose nearly 2 feet wide, are ruled with a three-color screen so that about a half milion squares cover each 35 mm. frame. A coating of collodion stained green is put on the base and a greasy ink resist applied to the surface by means of an engraved steel roller. A bleaching bath then destroys the green dye where it is not protected. A red line screen, and finally a blue screen are next coated in an analogous way, as the first screen. A special panchromatic emulsion of large sized grains is used as the last coating, so that on reversal of the negative, a fine-grained positive is said to be obtained. A projection method of making duplicates is said to have been perfected.

New Device to Solve Fresh Print Problems

To eliminate blurring of new film by oil that projectionists put on new prints which have a tendency to pull sprocket holes on first and second showings, N. M. LaPorte, of the research department of Paramount-Publix, is cooperating with the organization responsible for the processing work for that company. Within a few weeks, according to LaPorte, a mechanism which is expected to go far in solving this problem will be added to the processing unit.

"A careful check on a questionnaire form sent out to the field indicates very clearly that damage to prints is caused on the first or second showing," said LaPorte.

"The answers state that great difficulty is experienced in getting new prints to run freely through the projectors unless the projectionist squirts oil on the film.

This not only blurs the picture but later, when the oil dries, gives the film an appearance of buckling. However, it seems that after two or three showings the difficulty disappears and the print runs through the projector without pulling sprocket holes or causing any other damage. This pulling of sprocket holes appears to be one of the most serious reproduction problems today.

"For the benefit of those who might be interested in how we expect to eliminate this grave print trouble, we can state that we are cooperating with the company which does our processing work in developing an apparatus to be added to each processing unit. This apparatus will burnish that part of the print that comes in contact with the projector.

"After a print runs over the apparatus to be provided we shall have accomplished that which is tantamount to two or three exhibitions of film in the theatre, the difference being, however, that this operation of ours will have been done by an expert who knows his business and understands thoroughly the requirements of the theatre with regard to efficient processing.

"Heretofore projectionists have been powerless to help the situation because they did not know that sprocket holes were being pulled until the film was removed from the projector."

Some Common Causes of Reproducer Noise

Sprocket Noise—Caused when the film pulls over to the left in the projector, allowing the exciter lamp of the light-ray reproducing system to play through the sprocket holes of the film as well as the sound track. The noise is a rather high-pitched buzz, somewhat like a busy doorbell.

Flutter—This is a pulsation in the recorded tones. It sounds as if the speaker is gagging a bit over a mouthful of mush. It is caused by too long or too short loops in the projector, or loose pads on the track guiding the film. These things cause both picture and sound track to move in-and-out of focus.

Frame Noise—The opposite of sprocket trouble. Caused when the film is pulled in the projector too far to the right, running off the sound track onto the picture itself, playing, so to speak, the picture and the dark spaces between the frames. Sounds like a motorboat at high speed.

Motorboating—Same as Frame Noise.

Overspeed—When the speed is suddenly increased beyond the normal of 90 ft. per min. (33 1-3 r.p.m. for discs), the high frequency sounds are emphasized at the expense of the lower ranges. In other words a basso would sound like a soprano under excessive overspeeding.

Underspeed—When the projector is suddenly slowed down the reverse of the above occurs. The lower frequencies are emphasized, and a soprano would sound like a basso.

Dirt Noise—Film should always be carefully cleaned after each running, but sometimes this is not done. When this happens, specks of dirt form on the sound track. These specks cause variations of sound which are manifested in many ways—squeaks, whistles, firecracker noises, etc.

Loose Exciter Lamp—When the exciting lamp of the light-ray sound reproducing system becomes loose there is a distortion of sound.

Gear Noise—Noise recurring at regular intervals, dum-de-dum, etc., can usually be traced to loosened gears in the projector.

Blooping—This is a sudden "plop," usually caused by a bad splice between sections of the film. This can always be avoided by correct splicing, and properly blocking out the spliced patch in the sound track.

Insulation Noise—Some theatres have not yet installed the heavier tripods and insulation pads required for sound reproduction. The amplifying tubes and the photo-electric cell are very sensitive to jar. Sudden "whack" noises from the screen are generally traceable to trouble caused by vibrations when the projectionist walks across a room in which the insulation has been badly done.

There are other noises which can be caused by accidents and by faulty handling of the equipment, but the foregoing are the major extraneous sounds which annoy theatregoers.

International PROJECTIONIST

Edited by James J. Finn

Vol. 1, No. 3
December, 1931

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MONTHLY CHAT

INTERNATIONAL PROJECTIONIST has begun to spread itself. Reaching out to the West Coast it has gathered to its bosom "Loudspeaker," West Coast organ of the American Projection Society. The arrangement naturally embraces a transfer of all assets of "Loudspeaker"—subscriptions, advertising, and prestige—to I.P. Paid subscriptions are, of course, of vital importance to any worthwhile publication; yet we like to think that of the aforementioned assets the most valuable is prestige.

I.P. is not insensible to the great responsibility it has assumed through consummation of this arrangement. Under the extremely able direction of Wallace G. Crowley, and by virtue of the support accorded it by Western A.P.S. men, "Loudspeaker" enjoyed an enviable reputation in the field and served its readers splendidly. We who work for I.P. are conscious of the new responsibilities for giving service and of our now greatly increased audience. We shall try hard to discharge our obligation to former "Loudspeaker" readers by doing, if possible, just as fine a piece of work as have Mr. Crowley and his associates.

Had we acquired a string of sectional motion picture periodicals throughout the country (Heaven help us!), we should not have been more pleased than we are concerning the "Loudspeaker" arrangement; and we earnestly hope that our many new readers will bear similar friendly feelings for I.P. This last should not be too much for which to hope, inasmuch as we shall continue to have the close cooperation of Mr. Crowley and his associates.

OVERLY optimistic as we are, we have concluded that William F. Canavan's resignation as President of the International Alliance will serve one useful purpose: it will teach all units and the entire membership the meaning of self-reliance, the need for which was not so pronounced during Mr. Canavan's tenure of office.

PROJECTION has much to look forward to during the coming year, if only because it has not received its rightful due during 1931. During the past year major emphasis was placed upon costs; production and reproduction were left to make their own way with whatever tools were available. It seems reasonable to assume that the equipment market will soon feel the impetus of purchases long deferred.

William F. Canavan

WILLIAM F. CANAVAN'S resignation as President of the International Alliance was preceded by one of the most vicious campaigns of personal abuse that this writer has ever seen directed at a man in Canavan's high position and with his record of unparalleled service to an organization and its membership. And these vicious tongues have not yet been stilled.

Canavan's resignation followed closely the adverse vote of the Local Unions of the Alliance on the question of a general wage reduction. But the outcome of this vote was no more the reason for Canavan's action than were any number of silly reasons advanced by some of the "bright boys" within the craft and by some of the self-perpetuating local "czars" who saw in the wage reduction proposal, and in Canavan's subsequent resignation, an opportunity for diverting attention from their own delinquencies.

Imagine the spectacle of a man like Canavan, who has devoted thirty years of his life to the Alliance, being subjected to the rawest, rankest type of abuse by those who are not worthy of even being seen in his company! Intellectually, Canavan towers head and shoulders over those who now wish to cast him into disrepute.

One may honestly question Canavan's judgement, but one may not, cannot question his honesty, his unswerving sense of loyalty and years of zealous efforts in the cause of the Alliance. And before anyone taxes Canavan with an error in judgement in sponsoring the wage reduction plan, one should reflect that the plan was okayed by every Executive, every Executive Board member, every representative and many Local Union leaders prior to its being broadcast.

This piece is not written in defence of Canavan. He is too important a personage to require any defence. One of the two outstanding executives in the American labor movement, Canavan has compiled a record that speaks for itself and which would be well-nigh impossible of attainment by anyone of his critics.

"Bill" Canavan resigned his office not because of the outcome of the vote on the general wage reduction; not because he was through fighting and sweating for the laboring man; not because he had "failed to click" on a "deal", and not because he had "something soft to step into". "Bill" Canavan resigned because he choked on the indigestible mass of rot that he was asked to swallow by a group of dull-witted persons the collective I.Q. of whom would probably be found to be — 3, if that high. "Bill" Canavan had a taste of the rewards he might expect from another 20 years of sweating. "Bill" Canavan didn't "run out"—he just walked out.

The Alliance could go on paying Canavan his salary for another ten years, without any work being done by him, and still not even begin to repay him for his labors in its behalf. For a man who has successfully floated so many "deals", William F. Canavan will probably surprise everyone by going to work for a living in the near future.

The motive behind this little essay is obvious. This little piece is admittedly an effort to pay public homage to one who this writer considers the very salt of the earth, to one who is deserving of nothing but the highest respect from his fellow craftsmen, and to one who has performed a difficult task in magnificent fashion. But more than anything else, these few words constitute a feeble effort to pay tribute to a man—a man's man, William F. Canavan.

JAMES J. FINN

INTERNATIONAL PROJECTIONIST

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FUNDAMENTALS OF TESTING ELECTRIC CIRCUITS

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TESTING is done to find out what conditions do or do not exist in an electric circuit. It is done with electrical instruments rather than "looking" for the trouble, because there are difficulties which cannot be found by looking—they occur somewhere within the apparatus or in some remote corner into which we cannot get to see what has happened. In other instances testing is resorted to because it usually locates the seat of the trouble quickly, whereas if we were compelled to look through all of the parts that are in any one circuit it would take considerable time, and when we finished we might find that the trouble is not in this circuit and the hunt would continue in another direction.

Do not get the idea that visual examination is of no value. A short inspection combined with the process of pulling and prying on leads, and so forth, will sometimes reveal the trouble in short order. In some instances visual inspection is required after the electrical tests have been made; at other times the two methods are used together. Placing the hand on a suspected wire or apparatus often gives an indication of trouble by the amount of heat that is present. This must be done carefully, otherwise a skin burn might result.

In order to know what kind of meter to use, what meter would be ruined if used on a certain test, or if the meter would ruin the part being tested, and also to interpret the results of the test, an understanding of ohms-law is essential. This need not frighten anyone; it is simple and requires only a rudimentary knowledge of mathematics. Ohms-law is simply a statement of the relation existing in a circuit between the voltage applied, the current flowing, and the resistance in that circuit. If any two of these values are known, the third one can be found either by multiplication or by division. When the current and the resistance are known, the voltage is found by multiplying the two known values. When the voltage and one of the others is known, the voltage is divided by the other known quantity. This relationship exists in all circuits no matter how large or how small the apparatus or the wiring may be.

The current is the result of the voltage and the resistance. It cannot be changed unless the voltage, the resistance, or both the voltage and the resistance, are changed. A change of voltage or a change in the resistance always causes a change in the current. If the voltage is increased and the resistance is increased proportionately, the current remains the same. If both are decreased proportionately, the current again remains as it was.

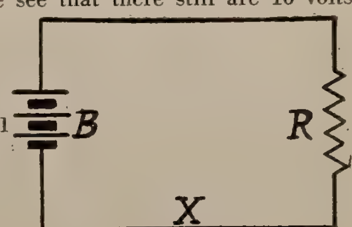
Let us consider a few examples in order to make this clear. In Figure 1 we have a battery, B, and a resistance, R, which are connected so as to form a closed circuit. For the first example we will assume that this is a small test circuit on the bench and that the connecting wires have no resistance. This assumption is never true, but the resistance of the wires in this case is very low and can be neglected.

The voltage of B is 10, the resistance of R is 5 ohms. If B is a storage battery in good condition, its resistance will be very small and can also be neglected. The current in such a circuit will be found by dividing 10 by 5, which shows that 2 amps. are flowing. A voltmeter across the battery will read 10. If the meter be put across R, it will also read 10. An ammeter inserted in the line at X will read 2 amps.

Placing the same resistance, which may be an electric light, at a point 100 feet away, we must use two connecting wires, each of which is 100 feet in length. The resistance of these two wires is 5 ohms and cannot be ignored, since it will affect the result a great deal. The total resistance in the circuit is now 10 ohms (5 ohms in R, and 5 ohms in the wires). Ten divided by 10 gives us 1. Only 1 ampere is flowing in the circuit now. One ampere is not sufficient to light the lamp properly. Let us see what conditions have acted to cause this.

Placing the voltmeter across the battery we see that there still are 10 volts

Figure 1



at this point. We place the meter across the resistance and get only 5 volts. Apparently some voltage has been lost between the battery and the resistance. Taking the voltage across the resistance, which is 5, and dividing by 5, the number of ohms, again gives us 1 amp. as the current.

To illustrate a different angle, we draw the circuit shown in Figure 2. R has been moved next to the battery, where it is connected by a wire having practically no resistance. The loop of wire extending from R to X and back to the battery is 200 feet long and has 5 ohms resistance, just as the two wires had in Figure 1 after R had been moved 100 feet from the battery. An ammeter will show a flow of 1 amp. A voltmeter across the battery shows 10 volts. The meter is now placed across R, and the reading is 5 volts as before.

One lead from the meter is then touched to point 2 at the lower end of the battery, and with the other lead placed on 3 at the far end of the resistance, a reading of 5 volts is obtained. Inspection of the drawing will show that we are measuring the voltage across the wire that connects the battery and the resistance, that is, around the 200-foot loop. It takes 5 volts of the battery potential to force the current through the loop of wire. We know that the resistance of the wire is 5 ohms. Dividing the voltage drop *in the wire* by the resistance *of the wire* gives us 1, which is the number of amperes flowing.

As the current remains constant so long as no change is made in the circuit and the battery is not discharged, then our answer in amps. must be 1, regardless of how the calculation is made, and right here we must watch our step. Notice the italics in the previous paragraph. To apply ohms-law we must be very careful not to get the various parts of the circuit mixed up. Had we taken the voltage of the battery and divided it by the resistance of the long loop of wire, we should have had a wrong answer. Mistakes such as this are very easy to make when dealing with circuits that are more or less complicated, but this is no fault of ohms-law. The law always holds good, and when it seems as though it will not work in some cases, it is because we do not use it properly.

The voltage of the battery (Fig. 2), is also the voltage across that part of the circuit starting at 1, through the resistance, R, out on the long stretch of wire to X, and back again to point 2 at the other end of the battery. In applying ohms-law, when we consider the voltage across the entire circuit we must also consider the resistance of exactly the same circuit. The result will then be correct.

Before passing on from Figure 2, let us make a different application of ohms-law. It is desirable to know what the resistance of the wire is from R to the point X. It would probably be 2.5 ohms, but this is not positively known. The voltmeter terminals are applied at 3 and at X, and the voltage is found to be 2.5. 2.5 divided by 1 gives 2.5, the number of ohms in that part of the wire.

To measure the voltage in this part of the wire it is necessary to have a wire on the meter about 100 feet long to reach X. In the present problem this makes no difference, but there are some cases where that length of wire would give an erroneous reading. We will discuss that phase of the problem in connection with other circuits later on.

Assume that we have two vacuum tubes wired in parallel, the normal filament voltage being 4.5 and the current through each tube 1.6 amps., or a total of 3.2 amps. for both tubes. A rheostat is in series with the tubes so as to cut the voltage from 6 to that required by the filament. The source of current is a 12-volt storage battery. A difference of 6 volts exists between the battery voltage and the voltage we need across the circuit in the amplifier, so a resistance is used to consume the excess voltage. We desire to find out what value of resistance it will take to produce the 6-volt drop.

The unknown quantity is the resistance in ohms; the two known values are the voltage to be dropped, which is 6, and the current that is to flow through the additional resistance, 3.2 amps. Dividing 6 by 3.2 gives 1.875, the number of ohms required.

In practice, a resistance of 1.8 or 1.9 ohms would be used. The rheostat will take care of the difference caused by the fixed resistance being of a slightly different value. Figure 3 is a diagram of the circuit. Actually there would be a switch and a number of wires connected to other circuits in the amplifier, but these do not affect the filament current and we need not take them into consideration. R is the fixed resistance, RH is the rheostat, and the two resistances, T, represent the filaments of the vacuum tubes.

While we have the circuit in Figure 3 under discussion, let us see what occurs if one of the tubes should burn out. As it stands now, we do not know the resistance of the filaments nor the resistance of that portion of the rheostat which is in use. We know that the current through the rheostat must be 3.2 amps., and we know the rheostat must cause a drop of 1.5 volts, from 6 to that required by the tubes, which is 4.5 volts. 1.5 divided by 3.2 gives a figure very close to .469 ohms, the resistance being used in the rheostat. The filament resistance of one tube is found in the same manner—4.5 divided by 1.6, or 2.8 ohms.

Possibly it isn't clear why we divide by 3.2 in one instance while in the other we divide by 1.6. The current through one tube will be 1.6 amps. when the voltage impressed on the filament is 4.5, consequently we must divide the voltage by 1.6. The rheostat is adjusted until the current through both tubes is 3.2 amps. This same current is also flowing through the rheostat, which causes a drop in the rheostat of 1.5 volts, so 1.5 is divided by 3.2 to find the number of ohms.

Having found the resistance of all the apparatus in the circuit we add them all together:—1.9 ohms in the fixed resistance, .47 ohms in the rheostat (.47 is close enough to the actual value, .469 ohms); and 2.8 ohms in the filament of the tube. The sum of all three resistances is 5.17 ohms. The resistance of the wires is negligible. Dividing the battery voltage, 12, by the total resistance in the circuit, 5.17, gives us a current of 2.3 amps. through one tube. This much current through a tube designed to carry only 1.6 amps. will very rapidly ruin it.

Next month our article will delve deeply into testing, and we will find ohms-law creeping into the picture again and again as we go along.

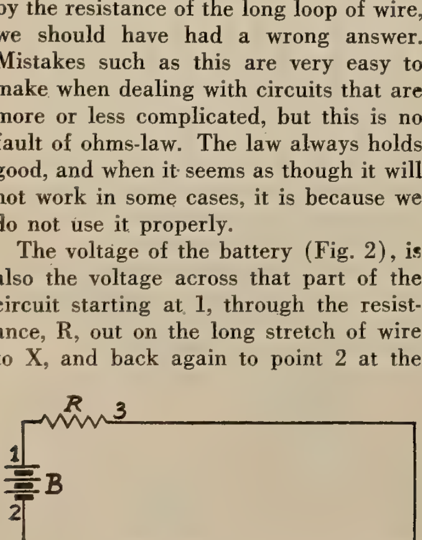


Figure 2

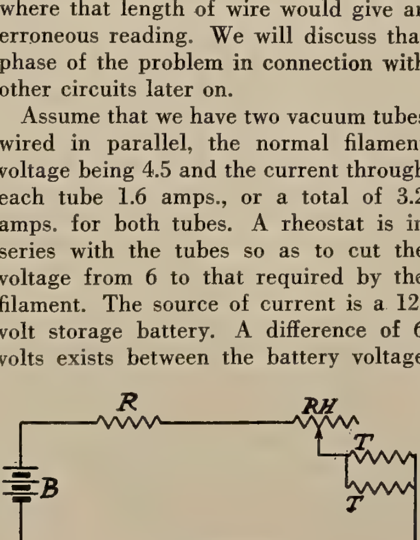


Figure 3

DISTRIBUTION of more than 450 baskets of food to poor families just before Christmas is the proud record of Local Union 160 of Cleveland. This job was handled in its entirety by the Local: the neediest poor families were canvassed and listed, the food was bought and the baskets packed and distributed by the Local membership. Also, the cost of every bit of the food as well as the job of canvassing, packing and distribution was borne by the Local.

Every member of the Local participated in the manual labor involved in this great task. Before work, after work, and often long into the night, men who had put in a full working day in projection rooms cheerfully "went to it" and contributed their bit to the success of the plan.

There may be better means than this for building community goodwill for a labor organization, but if there are, we have near heard of them.

J. J. F.

THE ART OF CONTINUOUS CINEMATOGRAPHY

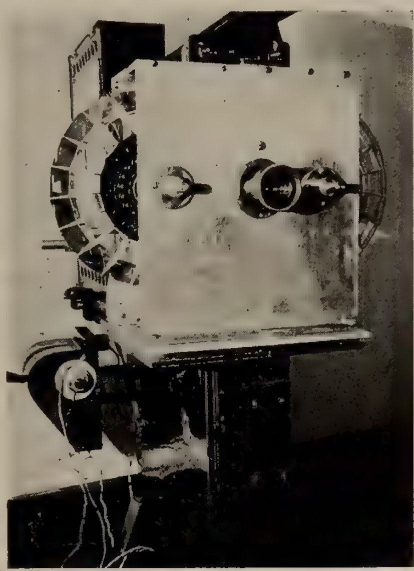
William C. Plank

II. The Mechanics of the Continuous Projector

MECHANICALLY, the continuous cinematograph is a simple device, there is nothing intricate about it whatsoever, and to project steady motion pictures upon this principle is easy. Steadiness becomes entirely a matter of workmanship, for the principle lends itself to great steadiness. But definition, or quality in the image, is entirely a matter of the optical principle employed. So continuous cinematographs may be very appropriately likened to objective lenses, in that it is a very simple and easy matter to obtain a mediocre image with them, but more difficult and involved to obtain an image having quality.

The cardinal requirement in the continuous cinematograph is a rectilinear or straight-line displacement of all the conjugate points. The definition and flatness of field will always be found to depend upon how perfectly this requirement is fulfilled. In the continuous cinematograph devised by the writer (see illustration), the compensating elements are rhomboidal-shaped[1] prisms which possess the rare and peculiar virtue of satisfying the above condition. In the continuous camera (see Fig. 1), they give a straight-line displacement to all the image points.

These totally reflecting prisms are revolved in such a manner that their faces are always maintained perpendicular to the optical axis. The axial ray, therefore, always enters and emerges normal to these faces. And in its passage through the two prisms it undergoes total reflection four times, in a manner somewhat similar to that in prism binoculars and other prism instruments. The conditions for definition are, therefore, similar.



Continuous cinematograph

The axial ray is displaced, not deflected, to compensate for the motion of the film. The advantage to be noted in this is that the compensating principle is independent of the objective lens. The moving film will appear stationary when viewed directly through the prisms, without the lens in place. Hence, objective lenses of any focal length may be used.

[1] A four-sided figure having its opposite sides equal, and its angles not right angles; lozenge-shaped.

Matching the Reflectors

Next in importance to the optical principle involved, is the matching of the plurality of compensating elements that go into a continuous cinematography, for this also has a great deal to do with the definition and quality of the image. Here, the reflective systems present an obvious advantage, for it is not difficult to match plane reflectors or optical flats. Any number of them can be matched so that the images reflected by them will match very accurately in size and composition. Needless to say, this is an important requirement in superposing them upon the screen without loss of definition in any part of the projected image. In a reflective element this virtue is not confined to a central portion only but extends to the very edge of the compensating element.

Given a compensating principle that is sufficiently perfect to satisfy the requirements as to definition, and a plurality of accurately matched compensating elements, the only problem remaining is to mount the compensating elements and index them with precision. Here again, the rhomboidal prisms evince peculiar and unique advantages. If their faces be maintained perpendicular to the optical axis, they become insensible to every adjustment or movement but one—the adjustment with respect to the radius. This makes it easy to mount and index them. (See Fig. 4.)

But a still greater advantage is that the precision or uniformity of the prisms cannot be affected readily in the mounting. The precision or uniformity of the optical intermittent movement depends upon the distance between the two parallel reflecting surfaces of the prisms, which may be ground and polished flat and parallel to within two wave-lengths. It is this precision that is not easily affected in the mounting of the prisms.

Precision Registration

Tilting a prism with respect to the optical axis (see Fig. 3), will move the projected image laterally upon the screen; and adjusting it with respect to the radical position will move the image up or down. It will be seen, therefore, that these two adjustments suffice to make the

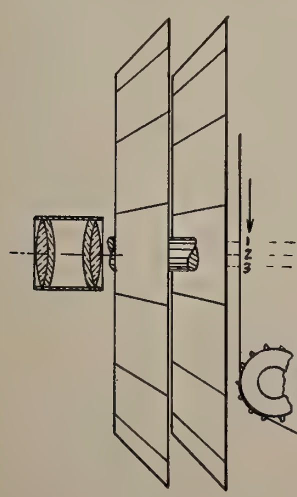


Figure 1

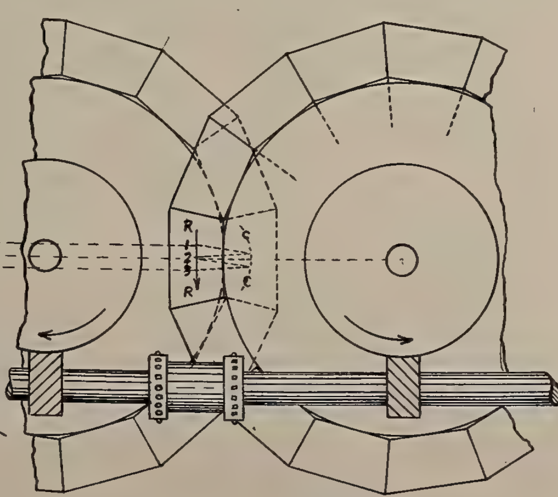


Figure 2

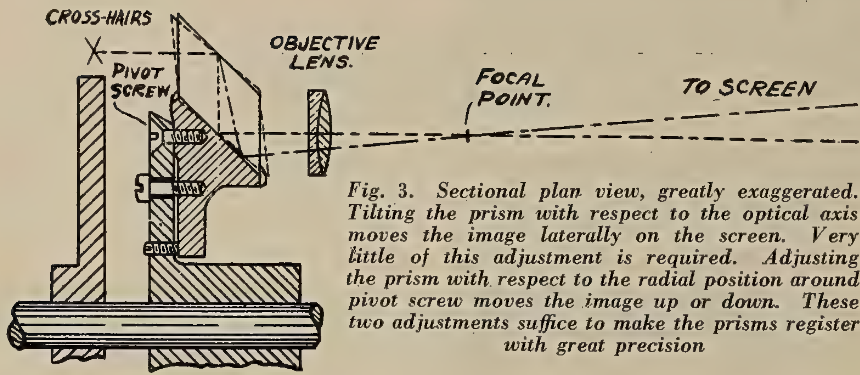


Fig. 3. Sectional plan view, greatly exaggerated. Tilting the prism with respect to the optical axis moves the image laterally on the screen. Very little of this adjustment is required. Adjusting the prism with respect to the radial position around pivot screw moves the image up or down. These two adjustments suffice to make the prisms register with great precision

prisms register with great precision when they are indexed. Each prism may be easily adjusted to make the image of cross-hairs register to within one-hundredth of an inch upon the screen, or even closer. In fact, this precision of the registration is only limited by the precision of the dividing head used for indexing. And assuming uniform motions in the prism wheels and in the film, this will also determine the precision of the registration of the successive images upon the screen. The really important thing, however, is that when the prisms are once indexed and fixed in place, the precision of their registration becomes permanent and cannot vary because of wear; otherwise such precision would be quickly lost.

A word should here be added about film shrinkage. In every continuous cinematograph means for correcting or compensating its effects should be provided. In our rhomboidal-prism cinematograph this means is very simple and effective. A thin lens is interposed between the compensating prisms and the film; and by adjusting this lens the film can be magnified up to its proper size. The amount of magnification necessary is very little, for although film shrinkage is measurable in a foot of film, in one or two frames it is almost inappreciable.

By using a variable speed drive for the film, it can be shown that the frames move downward on the screen if the velocity of the film be too slow, and upward if it be too fast. Synchronism of the film photographs with the compensating elements is, therefore, necessary to maintain the picture in frame. The factors that enter into the registration of the continuous cinematograph are four. And it can be proved that if there be synchronism, a uniform motion in the film, and uniform motions in the compensating elements, the registration of the successive images will depend entirely upon the precision with which the compensating elements were adjusted or indexed.

The projectionist will now see why precision in motion picture projection has been advanced to a new high. It is a precision of so high an order that the factor of wear must not be allowed to enter into it, else it were futile and a waste of effort. But registration is now upon a much higher plane. It concerns itself only with uniform motions and no longer deals with wear. Wherever wear occurs in the mechanism, it is of no particular concern as long as it does not affect the uniformity of the motions. And, fortunately, the wear in a continuous cinematograph does not: for parts such as the spiral gears, which revolve the compensating wheels in opposite directions, may be worn thin without affecting the uniformity of the motions.

The Gear Train

These right- and left-hand spiral gears constitute the heart of the mechanism. In the simplest form of the device, the sprocket is mounted on the shaft which carries the right- and left-hand spiral pinions, and this reduces the mechanism to but three moving parts, all of which revolve at unusually low velocities.

The wear on gear teeth depends largely upon the pressure exerted by them, or the amount of work they do; and it will be seen that the work in the continuous cinematograph is very light—turning over two freely revolving compensating wheels which, once set in motion, require but a minimum of effort to keep them revolving. The outstanding feature of this construction is, therefore, its extraordinary capacity for maintaining the precision. Wear is thus eliminated as a factor in the mechanism of the continuous cinematograph.

The foregoing considerations are sufficient to show that if a uniform motion be imparted to the film, the very summit and peak of precision in the registration of the successive images can be attained —and, what is of more importance, maintained throughout a long period of time. In recording and reproducing sound, many of our technicians have become familiar with the advantages of a uniform motion in the film, and have directed their efforts toward obtaining it. Impedance rollers and heavy fly-wheels are responsible for a technic that approaches the theoretical limit of perfection in imparting a uniform motion to the film. And the thing to be noted is, that it is accomplished without the slightest dependence upon the accuracy of the perforations. Wear and inaccuracies are thus eliminated as factors in the perforations of the film.

The perforations become of minor or secondary importance; and accuracy is no longer their predominant requirement. Their chief office is now to prevent the image from creeping out of frame. For this purpose only one row of perforations is necessary, and their size, shape, and number, may be varied greatly without affecting the results.

It naturally follows that those technicians who have learned how to impart a uniform motion to the film, and who appreciate what this means in precision, will be eager to see the registration of the successive images in the camera, in the printing machine, and finally upon the screen, likewise placed upon this much more accurate and scientific principle. And when they have reached this stage, we hold they have become uniform-motion-minded, a harmless distemper that is destined to become epidemic.

A Representative Opinion

But with every new art, there is a long struggle to overcome the effects of prejudice or propaganda and obtain a foothold. And those of us who have endeavored for years to create an interest in the fascinating art of continuous cinematography know what this inertia amounts to; for the greater the mass of an industry, the greater becomes its inertia. Every new movement meets with inertia, however, and must overcome it.

The following is an example of what has to be overcome in the average engineer, and it is given here because it represents very accurately the attitude of the motion picture industry itself with regard to the continuous cinematograph. About a year ago we happened to write to the secretary of a society of engineers upon the subject of continuous projectors, and he replied in part as follows:

"Frankly I have no faith in a continuous projector, although this is merely my personal opinion, which is the result of having inspected quite a number of them . . . . Even if a continuous projector could be made perfect in all respects, what of it? What would it do or offer in the way of advantages to offset the high

Fig. 4. The displacements have no effect upon the image

cost which seems to be inherent in this type of machine?"

It is the purpose of this article to tell what the continuous cinematograph *can* do and offer. Every projectionist is familiar with the erratic behavior of thin-spindled, easily warped, high-speed, intermittent mechanisms, when affected by heat, dryness, stickiness or grit. He has witnessed erratic projection with new mechanisms and, of course, he knows how soon precision can be lost because of wear. The fact is, with intermittent projection, steadiness is a variable quantity; and we have all witnessed instances of eye-straining unsteadiness in some of our best theatres. These instances of erratic projection may be traced to the erratic behavior of the intermittent mechanism, or to the condition of the perforations on the film.

With the intermittent principle the registration is absolutely dependent upon the accuracy of every perforation on the film. This is an inherent defect, for it is inseparable from the imperfect and unscientific principle of the registration. It is one of the crudities of the intermittent method, for the film (a non-metallic material), is made one of the most important and sensitive parts of the mechanism. It is employed as a mechanical chain, connecting the frame at the aperture with the teeth of the sprocket. But how crude its links appear, in contrast with the quality of the material and the finish of the other equally sensitive parts of the precision mechanism. Instead of being made of the finest steel they are made of thin celluloid, highly subject to wear, to breakage, and to loss of shape. Among the other parts of the precision mechanism this crude chain is an incongruity.

But this is not all. Instead of subjecting it to a treatment more in keeping with its crudeness and the material of which it is made, a miracle in the way of performance is demanded of it—precision of a high order at the extraordinary rate of twenty-four severe jerks a second. It is no wonder, therefore, that instances of consistent projection are rare, and perfect projection rarer. And although the crude chain seems to stand the strain, the projection can never be more accurate than its weakest link.

So it is worthy of note that the continuous cinematograph offers a real solution to the problem of erratic projection, whether the cause be in the mechanism or in the film. Old and badly worn film can be projected with surprising steadiness and smoothness as the registration does not depend upon the condition of the perforations.

Another crudity of the formative or adolescent period of cinematography is flicker. Whether perceptible or imperceptible, flicker is a crudity in motion picture projection for which there is no public. And this is possible only because the public does not know it.

The "Belladonna Effect"

On account of the "Belladonna effect" (the undue dilatation of the pupils when viewing intermittent projection), many instances of injurious practice occur throughout the country. The excessively brilliant light-periods or "peaks" strike in upon an unprotected retina through an aperture or pupil that is much too large for their intensity. This is the natural consequence of the inability of the iris to respond at the high frequencies employed. It becomes more or less fixed or adjusted to an illumination on the retina that is an average of the different intensities of the intermittent light falling upon it. The aperture or pupil thus formed will be suitable for this average brightness, but for no other. Under these artificial conditions the iris fails to adapt the eye to the excessively brilliant light-periods.

The idea that the human eye becomes adapted to intermittent illumination is a mistaken one. Insidious and unnatural conditions attend the artificial adaptation. This can be made more apparent by an exaggerated example—viewing a bright light source through a revolving shutter. By increasing the area of the blade without restricting the opening, a high intensity arc could be viewed directly; but it is obvious that this kind of adaptation would be false and unnatural.

But if the excessively bright light-periods in intermittent projection are a crudity, the dark-periods constitute another. The alternations of the two extremes give a screen luminousity curve of which no projectionist will boast. In fact, such a curve will serve to illustrate what a screen luminousity curve should not look like—and why. One of these reasons is that the alternations of brilliant light with darkness form an ideal condition for inducing photo-electric effects within the retina. Nerve and retinal fatigue are the only possible results, for they can serve no useful purpose.

A defect associated with eye-strain is the loss of definition in horizontal lines, which has become more prevalent since higher rates of projection have been in effect. This is sometimes due to motion or "creep" in the film during the so-called stationary period. A loss of definition in the horizontal lines is so indicative of this condition, that the projectionist will appreciate the fact that the continuous cinematograph actually gives a true stationary period at the highest possible rate of projection. This improves the definition and lessens eye-strain.

We hope that we have now pointed out to projectionists the new things made possible through the art of continuous cinematography. It is a new art, and accomplishes new and important effects by novel methods. But there is no doubt that it will become a great art. Its field or scope is broader than that of intermittent cinematography. The restrictions as to the size of frames or the rates of projection are removed, almost entirely. Its flexibility ranges from four frames a second to more than four hundred. This makes possible great advancements in reproducing sound as well as motion. In registration we have shown it to be more accurate, and in the substitution of the successive images, more subtle and scientific.

In the future it has great possibilities; but the immediate reality and fact is that this new art brings comfort to the eyes, and adds life, roundness, and beauty to motion pictures.

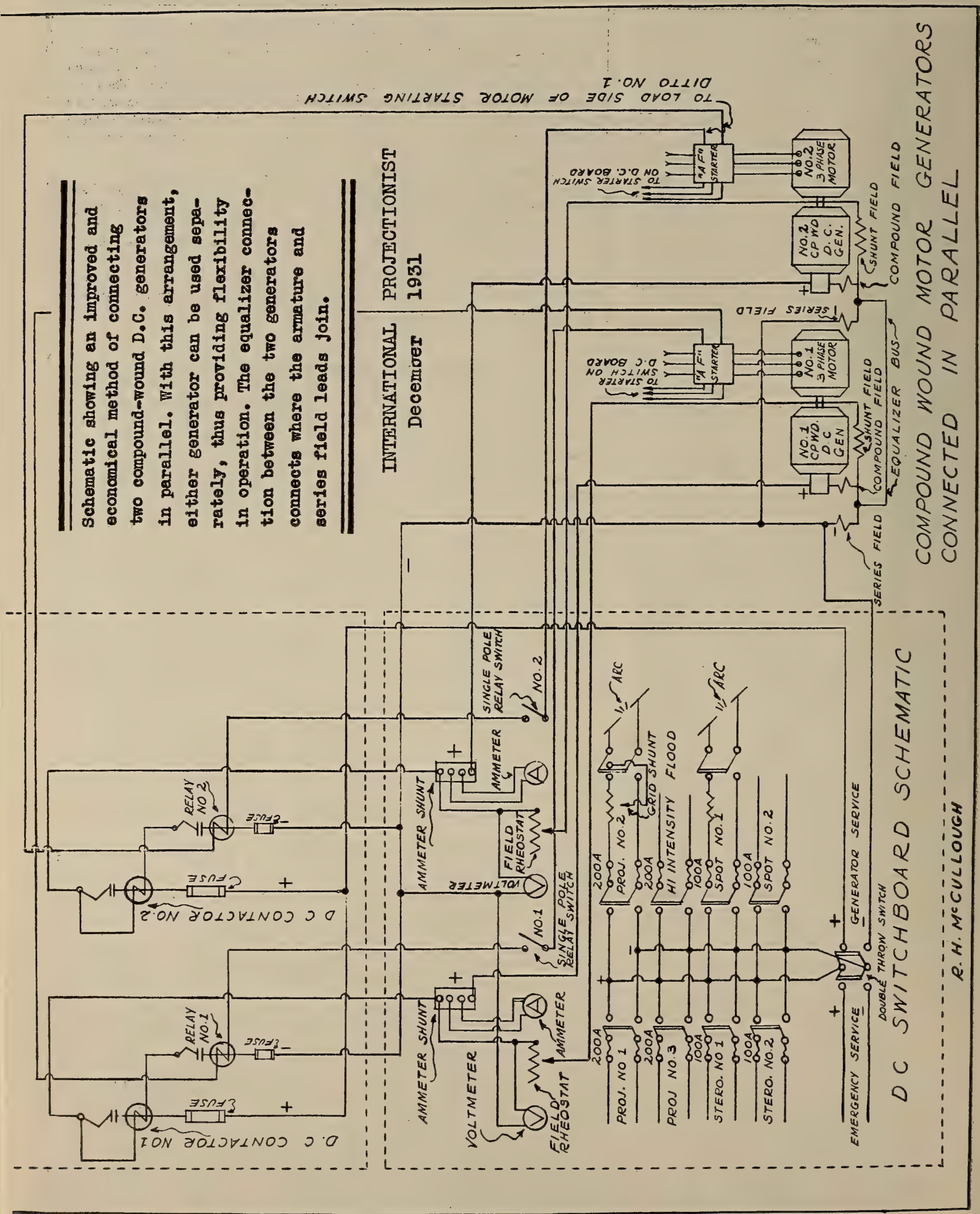
[Editor's Note: *Mr. Plank will be glad to answer in these columns any question relating to continuous cinematography. Inquiries may be addressed to Mr. Plank in care of this publication.*]

SPUTTERING AT THE ARC

SPUTTERING at the arc may be caused by carbons not being properly set or trimmed, or too short an arc; more frequently, though, it is caused by a damp carbon. Carbons are porous and absorb moisture. They are baked at extremely high temperatures; and when they leave the factory they are thoroughly dry. In shipment, however, they may be exposed to damp weather, or at destination stored in a damp basement. Carbons should be kept in a dry place.

A great many projectionists have formed the habit of laying a few carbons on top of a rheostat in order to expel any moisture that might have been absorbed after leaving the factory. Others put a trim in their lamphouses before burning. Either practice is a good one and is to be recommended, as a damp carbon may chip at the crater in addition to causing a sputtering arc.

Carbons are not perishable: they will be as good ten years from now as they are today. If they have absorbed water only, they can be dried out in the manner just referred to. However, if a chemical has been spilled on them, they may be rendered worthless, depending upon the nature of the chemical.



Schematic showing an improved and economical method of connecting two compound-wound D.C. generators in parallel. With this arrangement, either generator can be used separately, thus providing flexibility in operation. The equalizer connection between the two generators connects where the armature and series field leads join.

CONNECTING D. C. GENERATORS IN PARALLEL

R. H. McCullough

DIRECTOR OF PROJECTION AND ELECTRICAL EQUIPMENT, FOX WEST COAST THEATRES

THE theory and design, and also the electrical connections of direct-current generators, is one of the most interesting branches in connection with motion picture projection. Direct-current generators are classified according to the method of energizing their field magnets—such as series-, shunt-, and compound-wound. The compound-wound machine is most commonly used for motion picture projection purposes.

Shunt and series field coils form part of the compound-wound generator, which provides automatic electromotive force regulation. A generator is said to compound as the generator voltage increases with line load increases. A compound-wound generator is termed to be "flat compounded" when the voltage remains practically constant for all loads. Providing the compounding is properly adjusted, the series field will correctly regulate the voltage for all changes in load within limits.

To obtain the best results with generators connected in parallel, they should be of the same design and construction and should possess as nearly as possible the same characteristics. While any number of generators may be operated in parallel, we will confine our explanations herein to the operation of two generators.

It is not practicable to run a compound generator and a shunt-wound generator in parallel because when excessive load is placed on the line the shunt generator will drop in voltage, and unless the field rheostat is adjusted continually for the shunt generator, the compound generator will take more than its share of the load. An equalizer connection between the two compound generators is required when it is desired to connect them in parallel.

Equalizer Connection

The equalizer connection between the two generators operating in parallel connects where the armature and series-field leads join. This connects the two armatures and series-field coils of the two generators in multiple. This provision will divide the load between the generators in proportion to their capacities.

If the generators were operated without an equalizing bus, and if for some reason there was an increase in speed of one generator, it would take more than its share of the load. The increased current, which would flow through its series-field, would naturally strengthen the magnetism, which would raise the voltage and cause one of the generators to carry a still greater amount—until it carried the entire load. Therefore, an equalizer bus always insures uniform distribution among the series coils of two compound generators connected in parallel.

If both generators are alike and possess the same characteristics, the current in each would be one-half the total at all times, since at the same terminal voltage the same value of current would be delivered by each. It is concluded that generators having unlike characteristics will not operate satisfactorily in parallel; whereas those of like characteristics will.

Accompanying this article is a schematic which presents the simplest outline for connecting two compound motor generators in parallel. With this method of connecting two generators in parallel, either generator can be operated separately if it is desired to do so, thus providing for flexibility in operation.

Correct Procedure

Assume that No. 1 generator is running at the correct r. p. m.—the armature of generator No. 1 is generating its full voltage, which is indicated on the voltmeter—the following procedure is necessary to complete the circuit from the generator to the d. c. board:

The No. 1 single-pole relay switch, which is manually operated, is closed, which causes relay No. 1 to close, thus causing the d. c. contactor of No. 1 generator to close. The coil of relay No. 1 is energized from the load side of the motor generator auto-starter, or across the line starter, whichever it may be. When the relay coil is energized, this permits the relay contacts to close, thus energizing the coil of the d. c. contactor. When the d. c. contactor is closed, the circuit is completed. The relay coil is connected to the load side of the motor generator starter for the protection of this circuit.

All types of motor generator starters are provided with an overload relay, and any overload which may be placed on the motor generator set, would automatically break the motor circuit and, providing this circuit was broken through an overload, the energizing circuit of the relay, which causes the d. c. contactor to close, would automatically be broken until the motor generator was again started.

The d. c. contactors for each of the generators connected in parallel are connected to the positive leg of each generator. The voltmeter, ammeter, and field rheostat are connected ahead of each d. c. contactor. The voltage of each generator should be the same when operating in parallel, therefore it is always advisable to check the voltage before closing the circuit of either generator. If the voltage is high or low, correct same by varying the field resistance accordingly.

Cutting-In No. 2

If it is desired to use only No. 1 generator for a certain period of time during the day or evening, and then later when generator No. 2 is required for the heavier load, generator No. 2 may be started as per starting instructions of No. 1 generator. When generator No. 2 is up to full r. p. m. with full voltage, then throw-in the single-pole relay switch for No. 2 generator, which completes the paralleling circuit. No. 1 and No. 2 generators are now operating in parallel. Motor generator No. 1 and No. 2 may be cut in and out of the paralleling circuit as desired. Either motor generator may be used as desired.

If both generators are used at all times, there are a few points which should be considered. For the protection of the circuit, always be sure that the relay switch is open before starting each generator. The generators may be started simultaneously, if it is desired to do so; however, it is not advisable to throw in both relay switches until the full voltage is attained for each generator. Always leave the incoming generator relay switch open until the generator has attained full voltage, after which the relay switch may be closed for paralleling.

Coupling Varying Capacities

Great care is required for paralleling compound motor generator sets. For disconnecting the motor generator sets from the paralleling circuit, the same steps are taken, only in exactly the reverse order, as explained for starting.

Compound generators of different size or current capacity may also be

WHY ANASTIGMATIC LENSES?

David Levinson and Alvin A. Hill

THE widespread introduction of "corrected" or anastigmatic lenses in projection work, prompted by changing conditions in the motion picture field and the constant desire to improve the quality of projection, is a matter of comparatively recent record. Projection lenses generally in use before the advent of anastigmatic lenses have in principle been of the Petzval type used in portrait work, or of the short-focus type, "which amounts essentially to a telescope objective with an achromatic condenser mounted a short distance ahead of the film, which functions simultaneously as part of the illuminating system and part of the projection objective. Both of these types are characterized by the very sharp central definition and a very limited portion of the field which can be called flat."

An anastigmatic lens is one that has been fully corrected for spherical aberration, astigmatism, and chromatic aberration.

Spherical Aberration

Spherical aberration arises from the nature of the curve used in "uncorrected" lenses. These lenses have spherical curves—that is, they are ground as part of a sphere. The consequence is that a section of a sphere, or an ordinary projection lens, not having curvature enough towards the center, has an infinite number of foci at different distances. There is a difference of the refractive power of different portions of the same lens, the marginal portions of the lens having an excess of refractive power as compared with the central portions which excess of refraction increases with the distance from the center.

Astigmatism, a form of spherical aberration, is created when rays from an object passing obliquely through a lens converge through two focal planes instead of coming to a single point. The images thus formed do not focus with clean-cut lines on the screen. There also is a decided lack of contrast, and the projected image is more nearly a monotone in gray than a true black-and-white.

"It is an unfortunate provision of nature," writes one scientist, "that a single lens applied to the task of forming an image gives us an image about as far from the quality we want as could well be and still have it recognizable as an image. The ideal image is the true projection of the object spaces onto a plane, such a projection as might be constructed by drawing single lines from every point in the object space through a pinhole and continuing them until they intersect the desired plane of projection.

"The images formed by a lens differs from this ideal in many respects. In the case of the pinhole, the image is equally sharp no matter at what distance from it lies the plane of projection, for it is assumed to be so small that only a single ray of light from any one object can pass through it. The lens, however, is of finite size and many rays from any one object are received by the lens. For perfect performance all these rays should be reunited by the lens in another point in the desired plane of projection (the focal plane of the lens).

"It happens otherwise, however, as is illustrated in Figure 1. Here there is represented an object point O lying in the margin of the field. Instead of the lens forming a point image of O, it forms as the nearest approach to it an elliptical spot of light at O'. If we explore the cone of light in the neighborhood of O', we will find that it nowhere comes to a point focus. At the place marked t in the diagram the light seems to be concentrated in a short line as indicated and, at another place, such as s, it again seems to be concentrated into another line at right angles to the line at t. t is the focus for the meridian of the line marked t, and s is the focus for the corresponding meridian of the lens.

"The phenomenon of the representation by a lens of object point O as a pair of perpendicular lines is called *astigmatism.* The distance from O' to the center of the distance between t and s is the curvature of field for this angle. The astigmatic difference (distance between t and s), and the curvature of the field will vary from point to point over the field depending on the angle of the field of view. The focus of all points t and s is a pair of curved surfaces which constitutes the image of the object plane. These surfaces are indicated by the dotted curves connecting t and s in the figure with the center of the image."

Correction Methods

Spherical aberration and astigmatism may be overcome by the use of diaphrams with bright light, which cut off all but the central rays, but in this case distinctness is obtained at the expense of brightness. Again, spherical aberration may be reduced by using several very flat lenses instead of one thick lens.

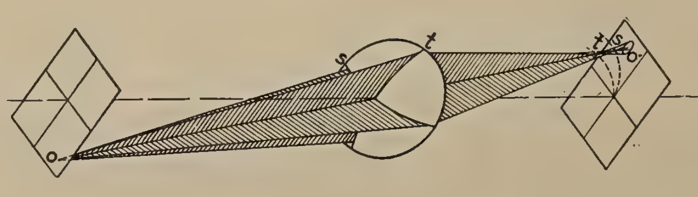
The most satisfactory correction, however, can be obtained with anastigmatic lenses ground on a system of computed curves that hold the accuracy of the lens surface curvature to within a few millionths of an inch. These lenses have similar refracting power throughout, which, under existing projection systems, is necessary to give the most evenly projected picture.

Chromatic Aberration

The dispersive (spreading), power of lenses, which are considered to be made up of any number of tiny prisms which bend light, is responsible for chromatic aberration. Chromatic aberration causes images to be reproduced on a screen with fringes around them, particularly around titles when the background is decidedly dark in contrast to lighter central features.

The serious defect of chromatic aberration, as the projectionist already knows, is most easily and quite effectively remedied by combining a convergent lens of crown glass with a divergent lens of flint, to form a convergent achromatic lens; or, if the crown glass is di-

Figure 1



Connecting D. C. Generators in Parallel

(*Continued from preceding page*)

coupled, provided, of course, their voltages are equal and provided their resistances of the series field-coils are inversely proportional to the current capacities of the two generators—that is, if one generator produces twice as much current as the other, its series-coil should have one-half resistance. It is further necessary that the two generators should agree in their action, so that a given increase in load will produce the same effect upon their voltages. If they are not in agreement, they may be adjusted by slightly increasing the resistance of the series coil of that generator which tends to take too large a share of the load.

Portraits
No. 1

THAD BARROWS

. . . who is rounding out his second year as President of Projection Advisory Council, and his seventy-second year (or so it seems), as President of Boston L. U. 182. Also, member of S.MP.E., Academy of M.P. Arts & Sciences, and of numerous exclusive Back Bay social clubs. Holds a paid-up card in the Alliance. Has been President of L. U. 182 for so long that even the gendarmes in Paris recognized the name when he flashed his card on them—despite the dim light of the station house. Used to be a jockey, but outgrew the profession. Parts his wavy brown hair in the center; likes the trotters and pacers; eats three apples daily, and receives initialled gold cigarette cases from comparative strangers. Is weighted down with honors, most recent of which is election as Captain of the Girls Team of the S.S. Leviathan. A swell Local Union officer and an even better projectionist.

vergent and the flint convergent, a divergent achromatic lens.

The introduction of sound-on-film pictures, to a marked extent, and wide films, to a lesser degree, have caused the noticeable demand for anastigmatic lenses. Had it not been for these comparatively recent innovations, it is doubtful if "corrected" lenses would have assumed the importance they now rate. With the advent of sound-on-film (which is now almost exclusively used), there arose the definite need for the undersize proportional aperture, to restore symmetry to the odd-shaped screen image caused by the presence of the sound track on the film. The undersize aperture, in turn, necessitated the use of a lens with a shorter focal length, to give magnification to the image and at least bring it up to an acceptable size.

With the reduced aperture and shorter focal-length lens there was a loss in brilliancy and an increase in aberration; following the formula that the shorter the focal length of the lens, the greater the aberration.

To insure less aberration and more brilliancy, brought about by loss of light through the reduced aperture and the increased light requirements of the perforated screen used in the presentation of sound pictures, the improved type of "corrected" lens has been introduced that not only copes with spherical aberration and astigmatism, but, further, provides an improved image quality for standard film, with a flatness and brilliancy of field that is comparable with, if not superior to, the images obtained in the "old days" of the larger aperture and longer focal-length lens.

Short Focal Lengths

Regardless of aperture size, if necessity demands it, larger pictures can be projected with "corrected" lenses from standard film. And, despite such high magnification, short focal length lenses of from $3\frac{1}{2}$ to 2-inch focus give a quality image that is well defined and characterized by commendable flatness of field. The projectionist is, however, more directly concerned with the already explained manner in which "corrected" lenses cope with the effects of the undersize aperture and short focal lengths required by sound-on-film projection. If he will make a study of these lenses and give them a fair trial he will no doubt find, as the writers have found by actual tests, that in the majority of cases they project a better sound-on-film picture.

This, then, is broadly the *why?* of "corrected," or anastigmatic, lenses.

Mark Time on New 3 x 4 Aperture

THE original specifications of .615 by .820 for the proposed new standard 3 x 4 proportional aperture are not likely to stand, according to developments of the past month. Numerous conferences between Lester Cowan of the Academy and representatives of projection and technical societies in New York emphasized the need for reconciling established theatre practices with any proposed new aperture size.

The consensus of opinion among projection representatives, men who are in a position best to understand the needs of the theatres, is that dimensions .590 x .825 would be most satisfactory to all concerned. An 18° mean distortion angle has been advanced as most desirable, although in the absence of definite data this estimate is necessarily arbitrary.

PROJECTOGRAPHS

Wallace G. Crowley

DINNER on a tray in my room and not alone—that's luxury in some countries, but not to me on matinee days . . . it's actual necessity . . . the room I referred to is the projection room . . . the company, another projectionist . . . did you ever try making a change-over while balancing a piece of pie in one hand? . . . A real projectionist is one who will in an emergency sacrifice the pie . . . That's a tough yardstick to measure up with . . . Saturdays and Sundays are our week-days wherein we work longer hours . . . It's great getting to watch the happy crowd making their ways to seats during a Sunday night intermission . . . You sort of realize that we are not one of the happy majority . . . We lead a life far apart from that of the butcher, plumber, clerk, or business man . . . While they play we work . . . Their amusement is our toil . . . Their idly-dropped fifty-cent piece is the source of our very existence . . . Ever count two rows of heads in a balcony and remark that there sits my week's pay?

Have you ever regretted the necessity of being away from home Sundays, holidays and evenings? . . . No idle chatting over the back fence with your neighbor on Saturday afternoon . . . No Sunday stroll through the park with the wife and kids, watching the array of happy humanity on parade . . . When the Thanksgiving turkey is only half-eaten you apologize hastily to the guests and hurry away . . . While the kids are happy with their new toys playing around the Christmas tree . . . One of them pauses and shouts, "Ma; where's Daddy?" The answer comes with just a touch of sadness in the tone, "He's gone to work at the show, dear" . . . If all this could apply to you—and you have no regrets or self-reproach, then you'll be a real success in this show business . . . *you heartless wooden Indian.*

Sitting at the bedside of a dying projectionist who said that he was glad he had been able to bring happiness to so many people . . . in the strained mock hospital gaiety the remark went unnoted . . . days later, after it was all over, it dawned on me what he really meant . . . he couldn't have lived in vain; his daily work was to cause lights and shadows to lull thousands of restless world-weary minds into forgetfulness—oblivion for a time—gained by staring at his handiwork on the screen. They *lived* for a time with kings and queens—returned to reality only when the curtain closed and the lights came up. They go their various ways better beings because of their brief respite from reality.

THE CHATTANOOGA TIMES: CHATTANOOGA, TENN., SUNDAY, NOVEMBER 29, 1931.

MOVING PICTURE PROJECTIONIST AND HIS WORK

Must Be Trained in Use of Delicate Machine and Whatnot.

BY R. M. COOKE.

"WONDERFUL direction; remarkable photography; perfect diction." These and similar expressions are frequently heard from patrons of the present-day movie show.

But has it ever occurred to movie fans that, in a little room far above the audience which thrills at the outstanding features of a screen production, are men upon whose shoulders, after all, rest the success or failure of the performance?

Nerves a-tingle, eyes, ears and wits attuned to detect the slightest imperfection, the projectionist, or operator, has put into the entertainment all the result of years of practical training, technical study and physical effort which are his contribution to this one of the most remarkable industries of all time.

A projection engineer, he likes to be called, and when those authorities who are making a life business of preparing the film for projection refer to his contribution as a specialized art the former lowly button-pusher swells with pride and often delights in regaling the layman with a dissertation upon the many technical points of his profession.

But, as indicated above, not always was the projectionist regarded as a vital cog in the presentation of moving pictures. In the early days of the nickelodeon he sat in a cubbyhole, dressed in a bathing suit, in a temperature considerably above 100 degrees, calmly defying the death-dealing fumes while he turned a crank until the reel was finished and then flashed the still to his patient audience, "One moment, please. Another reel will follow shortly."

Not Hard to Please.

NOR were those early patrons of the cinematograph hard to please. Frequent breaks in the imperfect films and accidents to the projection equipment were taken philosophically, and the optic-destroying flickering of the picture was regarded generally as inevitable.

But the outstanding development in the mushroom growth of the industry came with the advent of sound pictures. Instead of the boxlike room which housed the operator and the small crank-controlled machine is a well-appointed room 18x18 feet and in many cases larger, which provides comfort and sanitation for the projectionist. Instead of the old mechanisms there are two or more massive projectors, with a vast array of amplifiers, meters, rheostats, generators, batteries, converters, dials, indicators, gauges and an unending display of electrical what-nots. And the projectionist has played an important part even in the mechanical development of the talking picture.

P. A. McGuire, general advertising manager of the International Projector corporation, at a meeting of the Society of Motion Picture Engineers last fall, said privately to the local member of that body that every major improvement since the first imperfect talking picture machine was introduced has been made by a projectionist. The projectionist solved, in addition, many difficult problems which came with the introduction of sound and has repeatedly received the plaudits of manufacturers and engineers for his intelligent interest, practical knowledge and co-operation in the development of technical features of the industry. Without his specialized knowledge the introduction of sound pictures would have been a far more serious problem and wo[...] far less satisfactory at the [...] time.

Projection a Craft.

AN interesting picture of th[e] [...]ern projectionist was recei[ved re]cently by the local members [...] projection advisory council, a n[...] organization devoted to the p[...] technically of operating-room [...]ciency. It presents an angle [...] industry which is seldom con[...] by the layman and which it [...] purpose of the projectionist [...] quaint the public with.

"Projection is looked upon [...] trade or craft," the council sta[tes ...] says.

"It has been called a pr[...] and timidly regarded as an [...] a few people. An eastern ma[nufac]turing company recently, howe[ver ...] its advertising speaks of "Pro[jection ...] a Specialized Art." This adv[ertise]ment attracted widespread at[tention] and gave those skeptics who he[ld pro]jection lightly something to [...] about.

"Projection is unquestional[ly a] highly specialized field. No on[e can] really be considered a proje[ctionist] until he has had long practica[l expe]rience.

"An engineer from one of th[e] educational or commercial or[ganiza]tions might possess a complete [knowl]edge of these important subje[cts and] never make even a third-rate [projec]tionist. A man may be a goo[d me]chinist, a first-class repair m[an,] an expert electrician and fail [...] as a projectionist. Some e[...] sound engineers could not ha[ve be]come projectionists — althou[gh the] work may look easy enough t[o ...] —because they don't just fit i[n the] theatrical field.

"The motion picture industr[y ...] the show business, and a ma[n ...] does not realize that does not [...] in it. No matter what other [...]ing an 'operator' may have, [...] be just that and nothing mo[re ...] less he knows the show busin[ess. The] projectionist must be a shown[an ...] showman must be a good deal [of an] artist, for there is nothing f[...] standardized about entertaini[ng the] public. In the writing of th[e ...] in the taking and the making [...]

"Progress Through Understanding"

Further evidence of the splendid work being done by the Projection Advisory Council is presented here: a full-page story from the magazine section of a prominent newspaper, and a highly complimentary letter from the director of the Canadian Motion Picture Bureau exemplify the Council's slogan of "Progress Through Understanding."

Canadian Government Motion Picture Bureau

THE DEPARTMENT OF TRADE AND COMMERCE

Office of the Director
Ottawa

October 29th, 1931.

Dear Mr. Jones,-

I have to acknowledge, with thanks, your letter of the 21st instant advising me that I have been honoured by the Projection Advisory Council with Life Membership in this organization. Acknowledgment of your letter has been delayed through my absence from the city.

I am very proud indeed that the Board of Directors of the Projection Advisory Council have seen fit to honour me as they have done and I can assure you that I appreciate the honour done me in a manner that it is hard to find words to express adequately.

Motion Picture Projection, in the final analysis, is undoubtedly one of the, if not the most important phases of the transition of the motion picture from its original inception to its ultimate auditor. Projection, it may be said, can "make or break" a film and therefore is one of the greatest essentials of the motion picture art. Good projection is synomous with good pictures and success in the industry and I think this is becoming more generally recognized in other parts of the industry as each day passes. To those who recognize the essentiality of good projection it is an inherent duty to advance it in every possible way and it is this course I have followed realizing to some extent its tremendously potent value to our art.

The honour that has been given me by the Projection Advisory Council will be a great incentive to increase my efforts to in, every way, advance the cause of good projection.

Will you please convey to the Board of Directors of the Projection Advisory Council my great appreciation of the honour done me and the continued goodwill I hold towards them and the cause in which they work. I should like them to feel that "I am theirs to command" in any way I can be of assistance to their immensely valuable work in this industry.

My earnest wish is for the continued and increasing success of the work of the Council.

With kind regards, I am,

Yours faithfully,

F.C. Badgley

F.C. Badgley
DIRECTOR.

Laurence Jones, Esq.,
Secretary,
Projection Advisory Council, Inc.,
Box 96, General Post Office,
New York City, New York, U.S.A.

Projection Engineers Have to Specialize in Field of Work.

the frequent changes and the exacting requirements of the modern motion picture theater, the entire per formance depends upon the highly specialized training of the projectionist.

"The projectionist must take his responsibility seriously if he expects

A PURELY OPTICAL SLIT FOR SOUND-ON-FILM

R. C. Burt

DIRECTOR, R. C. BURT SCIENTIFIC LABORATORIES

Optical-mechanical slits are so extensively used in present-day sound reproducing equipments that there are many workers in the field who regard such a system as the only satisfactory means for light confinement. That such is not the case is proven in the accompanying article, a contribution by Dr. R. C. Burt to the Spring, 1931, Meeting of the S.M.P.E. While much of the research work done recently in connection with the "slit" has been induced by a desire to obviate existing patents, a careful reading of Dr. Burt's paper will serve to show that the purely optical "slit" needs no such excuse for its introduction, for the reason that it is able definitely to render improved performance. The literature on this branch of the art is not extensive, but further data may be secured through the references[1] provided elsewhere in this article. These references are not a part of Dr. Burt's article.

THE ordinary optical system for the reproduction of sound from records on film requires some form of limiting mechanical aperture of special shape. It is shown in this article that not only is the use of such a mechanical aperture not necessary, but the apertureless system herein described has desirable features not obtainable with any other system. In this optical system the image of a finite source of light is optically flattened and elongated until it is in the proper proportion for the light beam on the film. This image is then focused on the film by an achromatic lens.

As shown in Figure 1, this result is obtained by using special lenses. In an elementary system two of these lenses have cylindrical surfaces. One surface is negative, its axis being horizontal; the other surface is positive, its axis being vertical. The negative surface reduces the thickness of the filament image, and the positive surface draws out its length.

Figure 2 is a vertical section in which

- S is the source
- J is the virtual image of the source
- N is the negative surface
- P is the positive surface
- O is the objective
- F is the film
- I is the image on the film

[1] "Slits—Mechanical vs. Optical," by Samuel Wein and James J. Finn, *Motion Picture Projectionist*, Vol. 2, No. 10, July, 1929, p. 16.

It is evident that by properly selecting the power of the negative lens, the virtual image J can be made any desired size so that with a given objective lens, it will be reduced to the desired width at I.

Fig. 3 shows the plan section. Each element of the filament is drawn out by the positive lens P until, when observed from the objective, it appears as a long bar of light extending completely across the lens P. Light from each element is then brought to a focus at a point on the objective. This appears as an image of the filament along one axis only, being a striated vertical band of light which completely fills the objective. It is obvious that instead of one lens of given power, several lenses of lower power can be substituted.

In applying this optical system almost any available source of light may be used, and by properly selecting N and P, any desired size of beam may be formed. The length and width of the light beam required on the film, and the light source which it is desired to use, are usually fixed. Given the length of the light beam, the fastest short-focus objective commercially available is selected. Usually a microscope objective is satisfactory, as these are inexpensive, highly corrected, and have speeds up to f/1.0 or greater. Selection of such a lens automatically places limits on the location of the image J, as these lenses are corrected for a certain working distance, and this in turn determines the size of J.

Selection of the power and location of the lens P comes next because, knowing the length of the selected source, P is chosen so as to fill the objective O completely with light of intrinsic brilliancy, thus obtaining the highest efficiency.

The length of the negative lens N is now determined to give the required length of image I, and it is only necessary to compute N for the proper reduction of diameter of S to meet the specified value needed for J.

The mathematical solution of the above conditions is very elementary, requiring only the simple lens equation. Solution by maxima and minima for the shortest possible optical system with a given set of lens O and N is difficult, a graphical solution being much easier. The advantages of this system in comparison with others are easily understood and may be enumerated as follows:

1. A glance at Fig. 3 shows one that the objective O is completely filled at all points by light of intrinsic brilliancy from all points on the image J. Hence the system is 100 per cent. efficient, giving the maximum brilliance possible in the image I for any system using a source

Optical train of the apertureless system

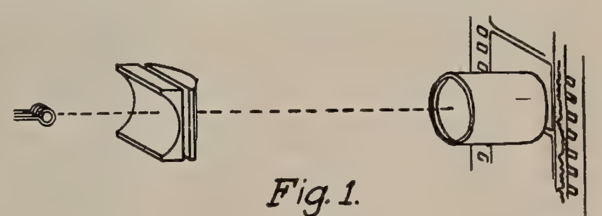


Fig. 1.

Vertical section of Fig. 1, showing the various elements

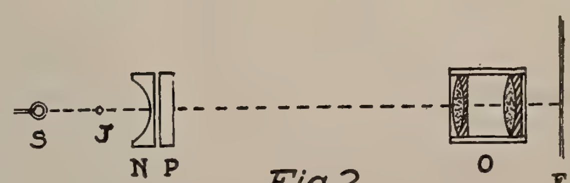


Fig. 2.

The plan section, illustrating the focusing of elements of the filament, forming a striated vertical band which completely fills the objective

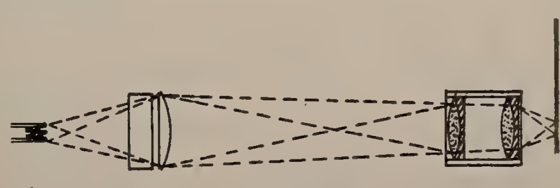


Fig. 3.

of light S and passing it through any lens. The only way a more brilliant image can be obtained is by using a faster lens at O, or by increasing the temperature of the source S.

2. It is not sensitive to position of the filament. Referring to Fig. 2, S may move up or down, forward or backward, with only a small change in the position of J, due to the effect of the lens N. As a result of this feature a standard source such as an automobile headlight bulb is perfectly satisfactory. Once designed, all standard headlight bulbs are perfectly interchangeable without any refocusing whatever.

3. The effect of azimuth errors in the filament do not appear as an inclined light image, but only as a very slightly broadened image. When using an automobile headlight bulb, the filament coil may be rotated 30 degrees from the horizontal and the light image width is increased only 60 per cent.

4. The image is very sharp, clean, and true, being formed by an optical surface instead of a mechanical slit as is the usual custom.

5. The most unique and important of all advantages is the fact that the light beam is perfectly uniform in intensity throughout its length. As will be evident from Fig. 3, this result is achieved because the horizontal image of the filament, which is composed of the coil elements, is focused on the objective O and consequently cannot possibly be in focus on the film. Furthermore, each coil element is drawn out by the positive lens P and is focused by the objective lens O upon the film, making a complete light beam in itself. It is the sum total of all such elements added together on the same line that make the fine, clear, brilliant image obtained.

This uniformity of light across the image makes a finer reproduction especially in the case of variable width recording, where variations in brilliance along the slit cause volume or harmonic distortions for which it is impossible to compensate.

DISCUSSION:

Mr. Palmer: I should like to know if Mr. Burt has any figures on the efficiency of his system. Can more light be gotten on film from the same light source than from the slit system?

Mr. Burt: We can get considerably more light than with a slit system. No figure of the efficiency of the slit system is available, and we cannot calculate the theoretical efficiency of a slit; but we have measured slit systems, and have found that the slitless system is about 4 times as efficient. The efficiency of this system is determined by the speed of the lens, O, and the intensity of the source, S. More light cannot be obtained from any optical system which uses a projection lens than from this system because the lens O is completely filled with light. Consequently, the amount of light that can strike the film is determined by the angle of the lens and the brilliancy of the source. If you trace out the light rays from all points on lens O, the filament S appears of intrinsic brilliancy throughout the field.

Mr. Palmer: How about using this for recording and getting an image of a glow lamp?

Mr. Burt: In a Movietone recording lamp, about 90 per cent. of the illumination comes from a little tube around that element approximately 0.125 to 0.25 inch in diameter and of a length from 0.25 to 0.5 inch. It becomes a problem to take illumination of that size and put it on the film in the form of a slit. We find that with an optical system 13 inches long, we can do it with one lens with a negative curvature on one side and a positive curvature on the other side, and reduce the image to a virtual image 0.006 inch in diameter and stretch it out to a length 6.125 inches long; and then focus this on the film 0.187 inch in length by 0.000085 inch in thickness.

Mr. Shea: With respect to the lamp problem it should be said that a great deal of development work has been done by lamp manufacturers during the last few years, and they have designed improved lamps for sound picture recording and reproduction. The efficiency of the lamp (its power consumption with respect to the light emitted), and the maintenance of high color temperatures over long periods of time, and the uniformity of the illumination across the filament are important factors. I want to make a plea, therefore, even if one has a good optical system, for using an equally good lamp.

Mr. Burt: When we were first working out this optical system the regular exciting lamps were difficult to obtain except by those licensed. We therefore had to use the best source at hand and to design our system around it. The automobile headlight filament is V-shaped and only rarely does one get a lamp out of line by so much as 10 degrees. We feel that the optics of this system are fundamentally sound for any light source. Furthermore, it is possible to make use of lamps with very small filaments because we have an optical system here which can make efficient use of any filament we start out with.

Mr. Larson: Have measurements of frequency response been made? What have the results been with respect to the high frequency range?

Mr. Burt: Theoretically, there is a slight limitation to the angle which can be used in an objective lens. If the angle gets too high, or if you use lenses which are super-fast, such as lenses of $f/1.5$, we get such large angles that the scattering is increased. This is true of all optical systems. So far as this optical system is concerned we can make the image on the film any degree of fineness desired. They have been made 0.0001 inch in width. In an actual test, one of the studios made a film experimentally which had a 15,000-cycle note recorded on it. The level was a little low, but it was put in a standard sound head using a slitless optical system, and we ran the film through. We took the current out of the head amplifier and passed it into a Bedell-Reich stabilized oscilloscope, and made the image stand perfectly still. We then examined the form of the 15,000-cycle wave and found it to be

PHILOSOPHIC BACKGROUND OF UNIONS

Sumner H. Schlichter, Ph.D.

TO the man in the street, the principal function of unions is to raise wages and reduce the working day. But this conception misses the main significance of labor organizations. Primarily they are significant because of their relationship to the government of industry. In the early middle ages, sovereignty and property were not separated—the ownership of land carried with it many powers that have since become functions of the state. The gigantic units of modern industry appear to be bringing about a reversion to the days when the sovereignty was an attribute of property.

With the ownership of property now goes the power to prescribe rules which affect employees as intimately as do the ordinances of the city in which they live, rules which prescribe when work shall begin, how long the men shall have for lunch, when work shall cease, for what reasons and how long employees may absent themselves without losing their jobs, whether payment shall be by the day or by the piece, by whom and for what reasons a man may be discharged, how promotions and lay-offs shall be made.

Modern business enterprises, unlike feudal lords, do not have their own courts, but in their control over discharge they have a rough equivalent.

Wage earners have sought, through the organization of trade unions, to resist the tendency of property to acquire sovereign or quasi-sovereign powers. Wherever trade unions have sprung up, they have sought to make shop rules a matter of joint determination and their administration a matter of joint control. In other words, in the place of despotism under which the word of the manager is final, unionism seeks to introduce the principle that decisions should be based upon rules and that rules should be based upon the consent of the governed.

as good as that of the usual 60-cycle line voltage.

MR. FOSTER: What is the angle of the microscope between the axis of the lens and the end of the image?

MR. BURT: That depends upon the selection of the lens, the diameter of the lens, and its focal length.

MR. FOSTER: Is there any difficulty due to curvature of field?

MR. BURT: No. Microscope lenses are corrected for flat field.

MR. FOSTER: Is there any falling off in the intensity due to the diminishing of the aperture of the lens as you approach the end of the lens?

MR. BURT: That is the thing that determines in these lenses what their correct field is. We are using a 16-mm. lens in order to cover a 2-mm. length. We do this is order to use the highly corrected center part of the field. We can make that angle as small as we want. Ordinarily for commercial work we select short lenses. In working with Fox they wanted a 0.25-inch length, so we had to make a longer foous lens in order to get a corrected field.

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Vastly Improved System Lends Impetus to Disc Recording

A GREAT advance in sound recording and reproduction was demonstrated recently to members of the S. M. P. E. and of the I. R. E. by Halsey A. Frederick, transmission instruments director of Bell Telephone Laboratories. Using disc records cut by the vertical method, a new high power amplifier, and latest types of loud speakers, Mr. Frederick produced an extraordinarily faithful reproduction of orchestral, organ, and vocal music, which his audience could scarcely distinguish from the original in either quality or volume.

The vertical method of recording on wax discs differs from the so-called lateral method which is standard practice in the phonograph and sound picture industries in that the groove instead of wavering back and forth along an otherwise spiral path is a true spiral whose depth varies in a perfect pattern of the sound waves which have been recorded. Such a method was the original conception of Edison but lacking modern electrical technique, it was superseded by the lateral method.

With the availability of microphones, amplifiers, and other electrical adjuncts to modern recording the old method now finds itself in the forefront of progress. Among reasons for its excellence is that the needle is no longer thrown from side to side by the vibrations, with the resulting over-travel and wear on the groove, but rather rides smoothly up and down.

Improved Mechanics

A close fit of the reproducing point in the groove—a requisite of the old method—was secured by incorporating a certain amount of abrasive material into the disc which would soon wear the steel needle to an approximate fit. This fit is not required in the new method and hence a permanent sapphire point is used in the reproducer with a resultant saving in weight of the steel needle and its clamping device. A further saving in weight is effected by an electrical reproducer whose moving system consists only of the tiny sapphire point, a coil of flat wire about one-eighth of an inch in diameter, and a bit of thin metal to hold the whole in alignment. On account of its lightness, the moving element is able to follow vibrations up to 10,000 per second with entire fidelity.

On account of the abrasive material embodied in the older records, the reproducing system was designed to eliminate from the output those frequencies above about 3,500 cycles, where "needle scratch" was especially conspicuous. A new method of preparing the original wax for recording, and the use of a finer grained material for the ultimate commercial records make the new record extraordinarily free from this source of noise and thereby brings about a much greater range in volume from the level at which surface noise would intrude on the program to the point at which the moving parts would be overloaded. Further increase in volume is enabled by the use of a vertical groove in which there is no danger, in the louder parts of the program, of the recording stylus overcutting into the adjoining groove.

A corner of the library in the quarters of A. P. S. No. 18, Cleveland, showing the many periodicals and books available for reference. This room contains a blackboard and a complete amplifier outfit for instruction purposes. It is richly carpeted and furnished, extends back for more than 22 feet and is 15 feet wide

Copying from Master

In copying from the original wax record, it has been the commercial practice to dust the wax with very finely powdered graphite. The particles of graphite were still large enough to contribute to the surface noise so that method has been abandoned in favor of depositing a molecular film of gold thrown down by an electrical discharge in a vacuum. On this gold film a layer of copper is electroplated and the whole is then backed up by a lead alloy. Further operations of pressing the discs are carried out much as in the present process but the ultimate records are pressed in cellulose acetate which has a surface texture extremely fine.

The power amplifier, which is the last of several stages of amplification, consists of two 1,000-watt vacuum tubes connected in push-pull. Mr. Frederick explained that, although its full 2,000 watts could be drawn upon if necessary, the reason for the use of such large tubes was in order that they might be very lightly loaded. With loud speakers responding to frequencies as high as 12,000 cycles, the spurious tones produced by a heavily loaded vacuum tube are distressingly perceptible and for this reason none of the tubes in the amplifying system are worked at more than a small part of their rated capacity.

S. M. P. E. Spring Meeting

The Board of Governors of the Society of Motion Picture Engineers has voted that the Spring Meeting of the Society of Motion Picture Engineers shall be held in either Washington or New York City, with a tentative date set for May 9 to 12. Choice between these two cities will be made by the members of the Society and ballots have been mailed to the members for their votes, according to W. C. Kunzmann, Chairman of the Convention Committee.

Washington is considered to be the more desirable city in which to hold an S.M.P.E. convention.

The IP EDITORIAL PAGE

Vol. 1, No. 3 DECEMBER 1931

The Indictment Against 'Soft Lighting'

Theatres today are getting the best projection work and the poorest quality screen images we have ever seen. No less amazing than the high quality projection work we have witnessed recently in ten states is the really abominable pictures these fine craftsmen are forced to put upon theatre screens. The blame for this condition lies not with the projectionist, not with inefficient equipment, and not with deficient film stock. Projectionists, theatre managers, and distributor district managers are in accord with our findings that the answer to this deplorable condition lies in just two words: "Soft lighting."

"Soft lighting" denotes the process whereby pictures are made in a studio with the use of incandescent lighting; "hard lighting" is the term applied to the system which utilizes carbon arcs as a light source.

Soft lighting is the curse of the motion picture industry today. This system had its inception shortly after sound pictures were introduced, at a time when the manifold worries attendant upon the introduction of sound, in addition to the then-existant problem of noisy arcs, made the producers easy marks for the high-pressure salesmanship of the incandescent lamp boys. While technicians wildly groped for some corrective for noisy carbon arcs, the incandescent crowd went to work on the harrassed and much too gullible production forces and in practically no time at all had effectively "sold" the motion picture industry upon the virtues of soft lighting.

The result of this bit of finished salesmanship is all too apparent today on countless theatre screens—even to the technical novitiate. Visit any theatre at random—the so-called de luxe theatre, a second-run house, or the famed "shooting gallery"—and gaze upon the screen image for just a few minutes. Every evil of incorrect lighting will be on display. There is no more contrast of black and white and no more definition in the picture image of today than there is in the much-ballyhooed television image. Watch the light as it follows any white image around the screen. And as for sets, why they use them at all with incandescent lighting is beyond us: it's just a waste of time, because nobody can see the set anyhow. Maybe fortune will reward your visit and bring a newsreel on immediately following the feature. Those who favor incandescents should pray fervently that fortune plays them no such trick in program arrangement, for there is nothing that so completely shows up incandescent lighting as does a newsreel, shot in daylight, immediately following an incandescent-shot interior scene of a feature. Up in the projection room the amperage is crowded on—80, 100, 125, 135, and 150 amperes are utilized. This is just a waste of current, because not even 200 amperes would improve the lighting of present-day feature pictures.

Who is there who can honestly say that commutator ripple is a serious bar today to the use of carbon arcs on a set? Do we hear an answer? We think not; for this difficulty has been overcome months ago. Then why the continued use of incandescents? Still no answer.

Let the producer representatives of this far-flung and far-famed motion picture empire speak out in answer to this charge that they knowingly and deliberately have been giving the motion picture theatregoing public an obviously inferior product for months past—and all because of a fancied—not real, mind you, but fancied—saving of a few dollars on each picture. Our mind is open, our back is strong, our skin is tough, and our columns lie yawning to rebuttal, and the stronger the better.

A Few Choice 1931 Prejudices

With 1931 fast disappearing around a bend in the road of Time (a circumstance which pleases us not a little), we should like to disport and pay tribute to a few of our private prejudices. We admit to being subject to violent likes and dislikes, but for so long as it takes to compose this little piece, we are overflowing with good cheer and in a mood fitting to render thanks to:

William F. Canavan, for a task magnificently performed; Western Electric Co., for "noiseless recording"; the producers, for forgetting all about wide film (not by preference, of course), but still, for forgetting; Harry Rubin and his Projection Practice Committee of the S.M.P.E., for the finest bit of practical projection work yet recorded; RCA Photophone, Inc., for background noise suppression; P. A. McGuire, who in the face of every possible adverse "break" didn't lose heart and kept plugging away on his P.A.C. work; RCA Photophone, Inc., for a swell all-A.C. job; George A. Yager, for splendid work in behalf of the socialization of labor unions; National Carbon Co., for pre-cratered carbons; Lester Cowan, of the Academy, for getting promoted as a result of splendid work along practical lines and, more important, making good our prophecy concerning him; Fred J. Dempsey, I.A. General Secretary-Treasurer, for acting on a "hunch"; Harry Holmden and Victor Welman, for the best-managed Local Union in the country (160, Cleveland); Toronto Local Union, for besting the "grading system"; International Projector Corp., for the Acme portable job; Max Ruben who invariably puts principle above profit; West Coast A.P.S. men who "took the bull by the horns" and seem in a fair way to put the Society on the map; Samuel Wein, who knows more about light sensitive cells and patents than we do; National Theatre Supply, for reducing prices; J. I. Crabtree, who as President of the S.M.P.E. gave projection a tremendous impetus; the television promoters for showing us how really bad televised images can be; the South Carolina State Council, for showing how much good work can be done by an organization of that kind; and to all those who differed with us and thereby provided opportunities to fight back, than which we love nothing more dearly.

SQUARES AND RECTANGLES

H. F. Dodge

MEMBER OF THE TECHNICAL STAFF, BELL TELEPHONE LABORATORIES

Included in the article relating to the proposed 3 x 4 image which we printed in our last issue was some very interesting data relating to the "ideal" proportions. According to Dr. Walter R. Miles, professor of experimental psychology at Stanford University and an outstanding authority in this field, the physical nature of the eye as well as long habit is against the nearly square shape of the sound-on-film picture as compared with the rectangular shape silent picture. The accompanying article, "Squares and Rectangles," probes deeply into this fascinating study of what constitutes the most pleasing proportions for graphic presentation—Editor.

WHICH of the three rectangles in Figure 1 do you prefer? Try to make your choice as abstractly as possible, regarding each rectangle simply as a shape. You probably will choose C. Most people do. If you choose the square A, or the rectangle B with its sides in the ratio of 1:2, it is perfectly all right. You may just be an exception. One of these more extreme shapes may better satisfy your own individual temperament.

Now refer to Figure 2, and again pick out the rectangle that you prefer. This is probably somewhat more difficult as the differences here are not so clearly marked. If a large number of persons were to state their preferences, however, rectangle D would probably prove to be slightly more popular than E or F. Rectangle D is the "golden" rectangle, with sides in the proportion of .618:1; E has sides in the ratio of .570:1; and F has proportions of .667:1 or 2:3.

Just what is it that determines the best proportions of any simple figure, the best arrangement and proportions of the objects in a painting? There will rarely be a perfect agreement among several individuals in the answer that they will give to any one of these questions. Tastes and preferences differ, often widely. But there are certain fundamental principles underlying this general type of problem, and what is "best" can only be determined from the opinions of those who are competent to pass judgment on the subject in question.

In connection with a recent study relating to standard convention in graphical presentation, the problem arose as to what might be considered the best proportions for a graphical chart. Most charts are rectangular in shape. Some are prepared for purposes of reproduction in scientific magazines or texts and are therefore associated with a panel of printed matter with which they should be related if possible in some way to give the appearance of page unity. In either case there are a number of interesting considerations that may throw some light on just why some proportions are more pleasing and stimulating than others.

The "Golden Section"

Searching through the history of art, one is impressed with the frequent reference to the so-called "golden section" wherever form and proportion are discussed. Fundamentally, the "golden section" is nothing more or less than the division of a thing into two parts (a) and (b), such that $a/b = b/(a-b)$; that is, the ratio of the smaller part to the larger is the same as the ratio of the larger to the whole, numerically .618/1.00. Whether applied to the sub-division of a line or to the proportion of simple geometrical shapes as shown in Figure 3, this ratio in days gone by, when the significance of numbers was regarded with awe and superstition, was believed by many to possess attributes of the divine, and to be the fundamental basis of natural beauty.

Today we are probably nearer the truth when we approach the problem from the standpoint of psychology. Some of the earliest attempts to discover aesthetic principles by scientifically con-

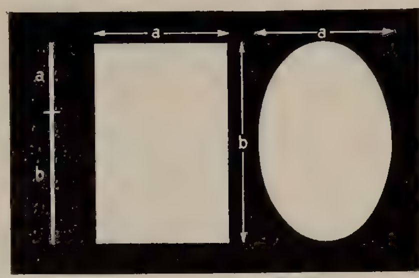

Fig. 3. Showing the proportions of the golden section

trolled experimental methods were made by the German physicist Fechner in the latter part of the nineteenth century.

In one of his experiments he laid upon a black background twelve white rectangular cards having the range of proportions shown in Figure 4, including one with the proportions of the golden section and also a square. About 350 men and women were asked to choose that which appeared to have the most pleasing proportions. They were asked to make their selections as abstractly as possible, and to free their minds so far as possible from all associations whatsoever. A number of the observers were not able to choose any one shape as best but could narrow down their preference to two, or in some instances to three, of the rectangles in the group. In such cases, the chosen rectangles were accorded a half vote or a third vote.

"Best" Proportions

The results of the experiment are indicated in Figure 5. It shows that the golden rectangle was preferred in about 35 per cent. of the cases. This in itself does not lend any prestige to the exact mathematical ratio of .618, for the wide spread of preferences would indicate that had he used a rectangle with sides in the ratio of 3:5 (.600) or 5:8 (.625) in place of the golden rectangle (.618) the 3:5 or 5:8 shape would undoubtedly show about the same pre-eminence. The important point brought out by this experiment is that the representation of measurements based on aesthetic judgments of many individuals is of the nature of a statistical distribution. Regardless of what proportions Fechner had used for his rectangles, the results would have been substantially the same.

Assuming that the data were good data, that the conditions under which

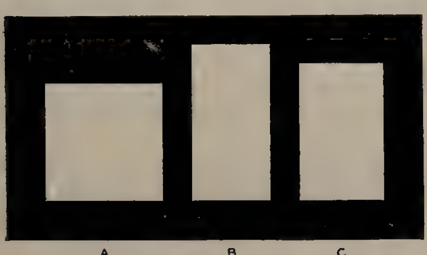

Fig. 1. Which shape do you like best?

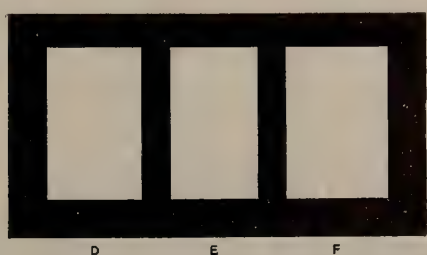

Fig. 2. What is your preference here?

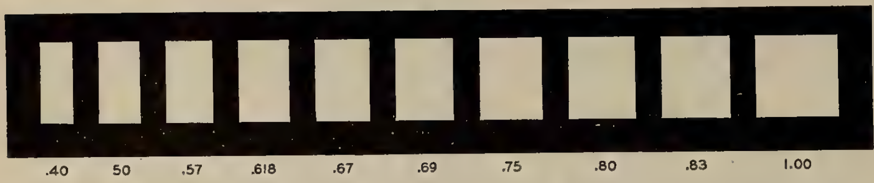

Fig. 4. Rectangles used by Fechner to determine the most pleasing proportions

they were obtained were well controlled—assumptions which appear well justified—the important information is lodged in the distribution curve that was obtained, in the average value and in the value of standard deviation or spreading out of the individual observations about that average. The observed average, .621, may be taken as an estimate of the true "best" proportion. With a possible error in the observed average of as much as ± .011 for a sample of 350 observations, such as were taken by Fechner, these results give evidence that the best proportion lies somewhere in the range of .610 to .632.

From the standpoint of convenience in design and architecture, there is practical value in using the exact proportions of the golden section in many cases, but from the aesthetic point of view, mathematical accuracy is of no great importance. Human preferences are not so exacting. It does appear definitely true, however, that most people prefer an asymmetrical figure to a purely symmetrical one.

A square with its perfect symmetry is almost always uninspiring and often disagreeable. The usual demand is for greater variety, for something that will awaken interest. The amount of variety in a rectangle that is considered pleasing depends upon the individual's grade of intelligence, his experience and his tastes.

Just why we desire a proportion approximating the golden section is somewhat speculative. Psychologists speak of the pleasure derived from adjustment of the human organism to meet complex situations. In line with this thought, Langfield, author of "The Aesthetic Attitude," believes that the "complexity" or inequality represented by the golden section taxes the adjustment of the ordinary organism to its limit."

If we add content to a rectangle, as we do when plotting curves in a rectangular graphical chart, the problem is made somewhat more complex. We are no longer regarding the rectangle simply as a shape. If, for example, we draw a vertical or a horizontal line inside a rectangle as in Figure 6, the effect is to change the apparent proportions of the rectangle. This would tend to dictate a different ratio of height to length than one would choose otherwise. Generally speaking, however, the content of a graphical chart does not exert an influence so strong as to modify materially what might be considered the best proportions.

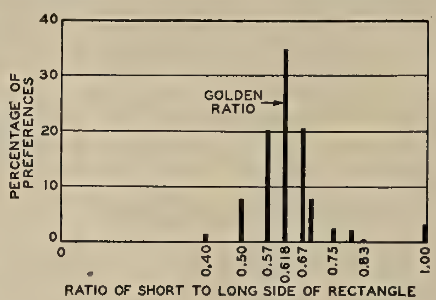

Fig. 5. Results of Fechner's experiments to determine the most pleasing proportions of a rectangle

Fig. 6. The apparent shape of a rectangle is affected by its content

Canavan's Resignation Follows Defeat of Rebate Plan

WILLIAM F. CANAVAN'S resignation as President of the International Alliance was tendered to and accepted by the General Executive Board of the I. A. at a special meeting of the Board at organization headquarters on December 9th. Previous to the filing and acceptance of Canavan's resignation, the Board had met to consider the outcome of the vote on the general wage reduction proposal made by the Board at an earlier meeting.

A tabulation of this vote submitted to the Board showed the following results: 364 locals voted "No"; 140 locals voted "Yes"; 72 locals were not affected; and 1 tie—making a total of 577 locals the votes of which had been received at headquarters at the time of the Board meeting.

During the discussion which followed the announcement of the locals' vote it was suggested that a special convention be called to allow representatives of the major circuits to appear before a committee of 100 and explain the necessity of the rebate plan. This plan was vetoed by the Board, which considered that the vote by the locals showed definitely how they stood on the rebate and indicated the futility of further action along this line.

Following the defeat of this proposal, Canavan submitted his resignation. Every member of the Board prevailed upon the President to continue in office until the next Convention at least; but Canavan refused to reconsider his decision to resign.

Announcement of Canavan's resignation, and the subsequent election of W. C. Elliott, heretofore first vice-president, as president was made in a telegram which was sent to all locals on December 9th. Two days later President Elliott, in a general letter to all locals, reviewed the sessions of the Executive Board and confirmed the acceptance of Canavan's resignation. Elliott's letter stated that the Executive Board was very reluctant to accept Canavan's resignation and did so only when it became evident that Canavan would not change his mind. Elliott further pledged that he personally and the members of the Executive Board would do everything possible to promote the interests not only of each Local unit but also of every individual member.

An extension of these remarks anent future policy is expected to be forthcoming shortly after the first of the year. Elliott spent the holidays at his home in Cincinnati.

Although Canavan has indicated his intention of returning to his former home in St. Louis on or about February 15th, there are many conflicting reports abroad as to his plans for the future. Canavan has disclaimed any intention of participating further in labor work, either for organized unions or for employers.

Latest Bull-etin

An excerpt from a current advertisement of a television book:

. . . *It is a book both for the interested layman and for the craftsman who will shortly depend on television operation for his livelihood. It has been written especially for the motion picture projectionist who will unquestionably operate television in the theatre as he now does sound equipment.*

MATHEMATICS FOR THE PROJECTIONIST

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THE motion of the film in its passage through the projector is the result of careful design of gears and shafts. Gears vary in size, but in a gear train intended to perform a certain work, each gear bears a definite relationship to the others. Let us consider a hypothetical case of gear mechanism: *Problem*:

Suppose we desired to drive a certain disc at a speed of 60 revolutions a minute by means of a direct-current motor the normal speed of which under a load is 1,800 revolutions per minute. *Solution*:

This speed reduction may be accomplished by any one of several methods:

1. Couple the disc directly to the motor shaft, and reduce the speed with a series rheostat; or
2. Couple the disc directly, and reduce the speed by applying mechanical opposition to its rotation; or
3. Couple the motor to a small gear which meshes with a larger gear.

Of these three possible methods, the latter is the most economical as well as most practicable; the others having inherent power losses. Since the motor makes 1,800 revolutions in one minute, and we desire to reduce this number to 60, the ratio is 30-to-1. Thus, the small gear must make 30 times as many revolutions as the larger gear which carries the disc.

To accomplish this work two gears are so machined that the larger one will contain 30 times as many teeth (not 30 teeth more), as the smaller one. If the small gear has, say, 10 teeth, the larger gear must have 300 teeth to produce the required speed of rotation (Fig. 1).

The Worm Gear

Where precision adjustment is required, a worm gear is most satisfactory. A worm gear consists of a threaded shaft which meshes with a cog-wheel. This arrangement is used where large ratio reductions are required. Where 14-to-1 reduction is required, it is quite easy to machine two teeth on the worm and 28 teeth on the cog-wheel. In such a case it would require one complete revolution of the worm to make the shaft move 1/14 of a revolution.

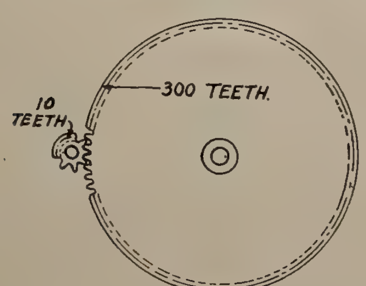


Figure 1

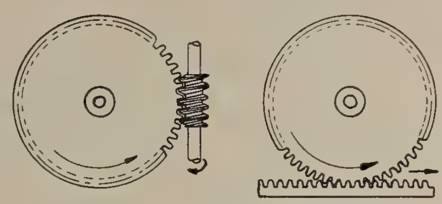


Figure 2

The rack and pinion, which is commonly employed to focus lenses, uses the worm gear principle (Fig. 2).

The Graph

In optics the formula is given:

$$\text{Intensity} = \frac{\text{candle-power}}{\text{distance}^2}$$

Reducing this to symbols:

$$I = \frac{\text{c.p.}}{d^2}$$

where:

d^2 = distance $\times$ distance
c.p. = candle-power

Let us consider the meaning of d^2. Assume a 32-candle-power lamp is mounted one foot removed from a screen. The brilliancy or intensity of illumination of this screen is 32 foot-candles. If we should move the lamp twice as far away, or 2 feet, the illumination on the screen would naturally decrease. The distance now being twice as great, we might say offhand that the illumination would be reduced by one-half. Such is not the case, for it has been proven that the intensity does not vary inversely as the distance but rather varies inversely as the square of the distance (distance multiplied by distance).

Using numerical values, let us make a table of illumination as compared with distance:

Intensity (foot-candles)	Distance (feet)	D^2
32	1	1
8	2	4
2	4	16
½	8	64

We may make a graph showing these values, so that we may ascertain the intensity at any distance within the limits of the graph (Fig. 3).

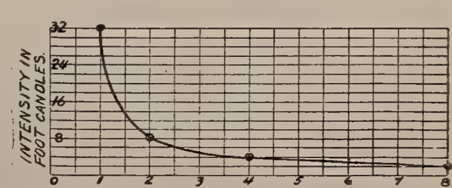


Figure 3

In reading this graph it may be seen that the intensity falls off quite rapidly as the distance from the screen becomes greater. If we were to continue to move further away, the intensity would be so small as to be negligible. The equation used to arrive at this conclusion is said to be a "second degree equation," which means that one of its terms varies as some other term whose numerical value is squared or multiplied by itself. This equation is frequently referred to as the "law of inverse squares."

In projecting an image upon a screen it is common experience to observe that the image may be made larger or smaller by simply adjusting the distance of the object from the lens. The size of the image is equal to that of the object when both the object and the screen are equidistant from the lens. This relationship is expressed by the following equation:

$$\frac{L_O}{L_I} = \frac{D_O}{D_I}$$

Where:

L_O = length of the object
L_I = length of the image
D_O = distance of object from lens
D_I = distance of image from lens

Problem:

Substituting numerical values in the equation, let us consider the placing of a piece of film 1 inch in length before a lens at a distance of 4 inches. The screen is, say, 50 feet away. What is the length of the image?

Solution:

$$\frac{L_O}{L_I} = \frac{D_O}{D_I}$$

$$\frac{1}{L_I} = \frac{4}{50 \times 12}$$

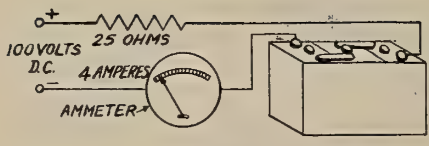


Figure 4

$4 L_1 = 600$, therefore, $L_1 = 150$ in., or 12.5 feet, *Ans.*

Suppose we made the distance between the film and the lens one-half as great. Then:

$$\frac{1}{L_1} = \frac{2}{50 \times 12}$$

$$2L_1 = 600$$

and: $L_1 = 300$ in., or 25 feet,

Although the image is now twice as large as previously, the intensity of illumination is one-quarter as great, figured according to the law of inverse squares. Conversely, if we double the distance of the object from the lens, the magnification will be one-half as great, but the intensity of illumination will be four times greater than previously.

Electric Power

It is desired to calculate the cost of running a ½-h.p. electric motor for four hours per day at the rate of five cents per kilowatt hour for a period of thirty days.

Formula:

1 h.p. = 746 watts, or
1 h.p. = .746 kilowatts
(since kilo = 1,000)

Steps:

.746 x 4 hrs. = 2.984 kilowatts daily
2.984 x 30 days = 89.520 kilowatts monthly
89.520 x .05 = $4.476, monthly cost

An electric lamp is rated at 500 watts. How large a fuse will be necessary to carry the normal current for this lamp in a 100-volt circuit? *Solution:*

$$\text{Watts} = \text{volts x amperes}$$

$$\text{Amperes} = \frac{\text{watts}}{\text{volts}}$$

$$\text{Amperes} = \frac{500}{100} = 5 \text{ amps.}$$

A storage battery rated at 100 ampere hours capacity is completely discharged. How much resistance must be inserted in series with the battery and a 100-volt direct current line so that the battery will charge in 25 hours? *Solution:*

(1) To deliver 100 amperes in 25 hours we must charge at the rate of 4 amperes an hour.

(2) By ohm's-law:

$$\text{Resistance} = \frac{\text{volts}}{\text{amperes}}$$

(3) $$R = \frac{100}{4} = 25 \text{ ohms.}$$

This answer is approximately true because we have neglected the resistance of the battery itself (Fig. 4).

Vacuum Tubes

We often encounter the term "characteristic curve of a vacuum tube." This curve is of great value in understanding the normal functioning of a vacuum tube, and of far greater value when the tube does not function normally. We all know, of course, that a heated filament emits electrons which may be drawn over to a metallic plate that is connected to the positive side of a high voltage battery. When a coil of wire (grid), or some other metallic shape is inserted between the filament and the plate, this grid can be made to control the number of electrons which reach the plate.

When the grid is given a positive charge by connecting it to a low-voltage "C" battery, electrons will leave the filament at a faster rate than when the grid has no charge at all. The reason for this is that the electrons coming from the filament bear *a negative* charge, and, since opposite charges attract, these electrons more readily leave the filament. Conversely, since like charges repel one another, a *negatively-charged* grid will repel the filament electrons, and will prevent them from leaving the filament.

By connecting a voltmeter across the "C" battery, and by inserting a milliameter in the plate circuit of the vacuum tube, we can ascertain how many volts on the grid are required to cause

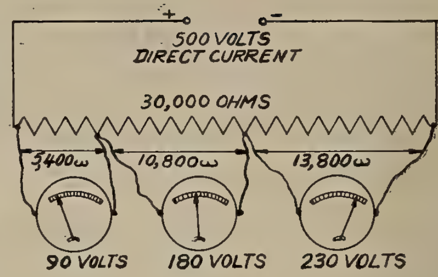


Figure 7

a particular current change in the plate circuit. This ratio is known as the mutual conductance factor of the tube (Fig. 5).

If we plot several values of *grid voltages* on one axis, and corresponding values of *plate current* on the other axis, a *curve* is obtained which graphically conveys the *characteristic curve* of the tube (Fig. 6).

It will be noted in the accompanying illustration that the curve is not linear. By this is meant that for each unit of *grid voltage* change there is no corresponding unit of *plate current* change throughout. At the lower left of the curve we find it rather flat; then more steep in the center; and finally flat on its top. The middle, or straight part of the curve, is most useful in amplifier circuits, for in this case, any small change in *grid voltage* produces a uniform change in *plate current.* Since the plate circuit feeds the loud speakers, a small voltage is impressed upon the grid of the first tube, which produces a large plate current change. This current passes through a resistance which provides a *voltage drop* for the grid of the next tube, and so on to the final stage.

Overall Amplification

The term *overall amplification* refers to the gain in voltage which a given amplifier is capable of producing when a small voltage is impressed upon the grid of the first vacuum tube. Consider the following problem:

Assume the output of a photo-electric cell to be 1/10th volt. This is fed into the grid of a tube the *amplification factor* of which is 30. If three tubes are coupled in a resistance-coupled amplifier, what will be the overall amplifications?

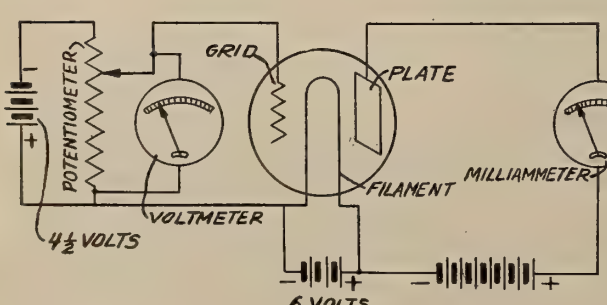


Figure 5

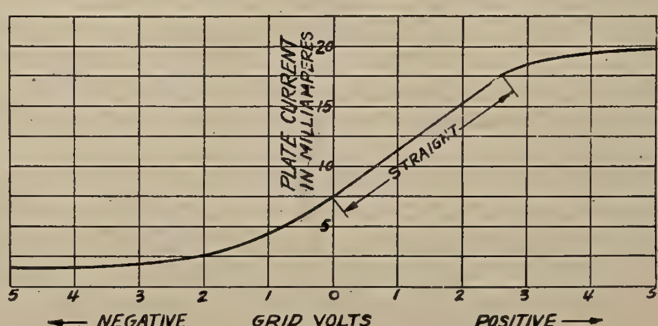


Figure 6

A SERVICEMAN'S DIARY

ADD to your list of "Things We Never Knew Before" (and, in fact never even suspected), the following interesting bits of information gleaned by Editor G. K. Rudulph for his RCA *Photophonews*. The stories had their inception with servicemen, yet at this season of the year we have charitable feelings even toward servicemen. Witness:

"Red rust found on sound head parts in the theatre at Port Orchard (Oregon), was attributed to salt sea air. However, other equipments—also at seaports—were not similarly affected and an investigation was made. Lubricating oil containing acid was eliminated when it was found that bright steel parts in the motor drive side of the heads were not rusted. It was noticed, in fact, that all corrosion occurred on parts exposed and liable to contact by the projectionists' fingers in course of 'threading-up', etc. A litmus test of the operator's skin showed excessive acid perspiration."

A serviceman in the Dallas District reported changeover relay, tube sockets, terminal strips, bearings, etc., in one theatre had been penetrated with dust. It was found, as the cause, that the cement floor in the booth perpetually flakes off in dust.

Another case reported the corroding of all electrical contacts. After an investigation it was found that the exhaust gasses of automobiles parked outside the windows entered the room and thereby became the corrodent.

Solution:

30 x .1 v. = 3 volts (after 1st tube)
3 v. x 30 = 90 volts (after 2nd tube)
90 v. x 30 = 2,700 volts (after 3rd tube)

In brief, the overall amplification of any amplifier is determined by the following formula:

$A = e \times (\mu)^n$
A = overall amplification
e = impressed voltage
μ = amplification factor
n = number of tubes

The term "μ" means that the amplification factor of the tube is multiplied by itself as many times as there are tubes. For example:

(1) With .1 volt and with one tube, the formula gives us:

$A = .1 \times 30^1$
A = 3 volts

(2) With .1 volt and with two tubes, we get:

$A = .1 \times 30^2$
$A = .1 \times 30 \times 30$
$A = .1 \times 900$
A = 90 volts

These calculations could go on for a great many tubes. In calculating for many tubes, however, one must take into consideration tube noise and other extraneous capacity and coupling effects which introduce elements of noise which are amplified along with our original voltage.

Voltage Drop

A power supply delivers 500 volts of direct current which has been properly rectified and filtered from the A. C. supply. Problem:

A 30,000-ohm voltage divider is connected across the output. At what points may taps be taken so as to produce voltages of 90, 180, and 230 volts, respectively (Fig. 7).

(Hint: The larger resistor will have the greater voltage drop.)

Solution:

$$(1)\quad \frac{90}{500} + \frac{180}{500} + \frac{230}{500} = \frac{500}{500};\text{ or}$$

$$(2)\quad \frac{9}{50} + \frac{18}{50} + \frac{23}{50} = \frac{50}{50}$$

Since there are 50/50th parts in 30,000 ohms, each 1/50th of the resistor is equivalent to 600 ohms.

Therefore:

(1)

$$\text{For } 90\text{v}: \frac{9}{50} \times 30{,}000 = 5{,}400 \text{ ohms}$$

(2)

$$\text{For } 180\text{v}: \frac{18}{50} \times 30{,}000 = 10{,}800 \text{ "}$$

(3)

$$\text{For } 230\text{v}: \frac{23}{50} \times 30{,}000 = 13{,}800 \text{ "}$$

$$50/ /50 \qquad = 30{,}000 \text{ "}$$

(*To be continued*)

Harland Holmden, B. A. of Cleveland Local Union 160, has been appointed seventh vice-president of the I.A. to fill the vacancy made by the resignation of President William F. Canavan. Holmden's appointment is effective immediately.

TELEVISION SECURITIES

THE following summary concerning several of the leading television companies is being distributed by a New York investment securities house which specializes in television securities, and will undoubtedly prove helpful to those interested in this art:

JENKINS—Incorporated in 1928 to promote ideas and patents of C. Francis Jenkins. Controlled at present by the De Forest Radio Co. Company is offering a television set for the home and has been operating television broadcasting studio for some time. Stock was sold in 1928 for $10 per share. Now on the N. Y. Produce Exchange and selling for about $2.50.

STANDARD—Company has taken over the Insuline Corp. of America which manufactures electrical parts and is offering television home sets priced from $37.50 up. Capitalization is for 1,000,000 shares of $1 par value. Insuline Corp. reported profit for nine months ending July 31, 1931 of $38,653.75. Factory is located at 23 Park Place in New York City. Stock is offered at $2.00 per share.

BAIRD—Company is an English company which is offering a television home set and operates a television broadcasting studio. A recent announcement was made that the company intends to offer a set in the United States to retail for $25.00 and has made arrangements for broadcasting with station WMCA in New York. Shares are listed on the London Stock Exchange and can be bought here for about 85c.

TELEPHOTO & TELEVISION — Incorporated in 1929 as the Telephoto Corp. to manufacture photo-electric cells and television tubes. Company has been supplying its products to Paramount-Publix, Universal Sound System, and others. The photo-electric cell, called the "eye" of television, has many other uses which gives the company several outlets for its sale. Company can supply kino-lamps and cathode-ray tubes for television receiving sets. Stock was offered recently for $2.50 per share and is now selling for $3 on the N. Y. Over-The-Counter market. President is Mr. Nicholas Fabian, who was President of the Televocal Corp., manufacturing radio tubes, which company was bought by the banking firm of Lehman Bros. in 1929.

SHORTWAVE & TELEVISION—Company has its headquarters in Boston, Mass. Offers a television kit and set and operates a broadcasting studio. Also sells a shortwave radio set. Stock is on the N. Y. Produce Exchange selling at about $2.00.

The television field generally has been very quiet for the past six months, with the exception of the recent Sanabria demonstration in New York.

AMERICAN LABOR MOVEMENT'S 50TH ANNIVERSARY

A review of fifty years of progress of the American Federation of Labor, with which the International Alliance is affiliated and in the councils of which it plays an important role

David Levinson

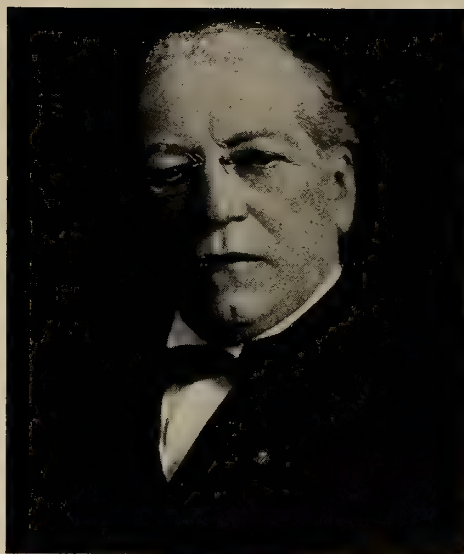
THE American Federation of Labor, of which the I.A.T.S.E. is an affiliated organization, is this year celebrating its fiftieth anniversary. It was in 1881—from which year the Federation officially dates its birth—that a group of labor leaders, dissatisfied with the loosely organized status of unionism in the United States, called a convention at Terre Haute, Indiana, to remedy the situation. At this convention, attended by large bodies of delegates from St. Louis, Cleveland, Chicago, and other Western cities, with Pittsburgh the only Eastern city represented, plans were made for a more representative convention, to be held the same year in Pittsburgh.

At Pittsburgh, with John Jarrett, at that time president of the Amalgamated Association of Iron and Steel Workers, as temporary Chairman, the Federation of Organized Trades and Unions of the United States and Canada, representing 262,000 workingmen, was formed. In attendance at this memorable gathering were 107, representing eight national and international unions: forty-two were from local trade unions; three were from district assemblies of the Knights of Labor, an organization which had been very active as a forerunner of the Federation of Organized Trades and Unions of the United States and Canada.

The organization which had been formed at Pittsburgh existed for but a short while, and finally faltered, principally because of the lack of funds. But, if this organization accomplished nothing else, it did serve to introduce to the public a man who was later to be proclaimed the greatest labor leader this country, if not the world, has ever had. This man was Samuel Gompers.

Rise of Gompers

At the third convention of the Federation of Organized Trades and Unions of the United States and Canada, held in New York in 1883, Samuel Gompers, who had come into prominence in national labor circles after having done heroic work with the Cigar Maker's Union in its fight against unfair conditions in that field, was elected chairman of the organization and of its important legislative committee.



SAMUEL GOMPERS
"Grand old man" of the American Labor movement

From 1883 to 1886, very little of importance was written into the history of unionism in the United States. But in 1886 the spirit that had been born in 1881 and subsequently had become dormant, was revived. The guiding geniuses and the masses of workingmen again felt the need for the display of a solid front of unionism.

The most important step towards the realization of this need came at the Columbus, Ohio, convention, in December, 1886. At this convention the old Federation of Organized Trades and Labor Unions amalgamated with large groups from many other unions, and thus the American Federation of Labor, representing some 300,000 members in good standing in twenty-five organizations, came into being, with Samuel Gompers as its first president, a post which he held down to his death in 1924, with the exception of one year.

Federation Gains

To what extent there have been gains by organization since the inception of the Federation fifty years ago is clearly shown by a review of some of the work of the A. F. of L. given by the executive council to the 51st Convention. This report discloses that the organization of the American Federation of Labor admittedly gave strength to the workers in 1881. From 1886 to 1890, the 8-hour day drives brought added leisure, cutting working hours per week from 63 to 58.

From 1899 to 1904, membership in the Federation increased from 349,122 to 1,676,000, and immediately workers gained in leisure and better pay. In the five years of membership gain, average wages rose 14 per cent. and hours were shortened by nearly two per week.

From 1904 to 1908, despite the business depression, labor still held its own. From 1909 to 1914 came another period of growth, during which time membership increased from 1,483,000 to 2,021,000, and gains in wages and hours were greater. Wages increased by 13 per cent. and hours were shortened by 1½ a week.

After 1913 began the wartime growth of trade union membership; membership was doubled and the increase in real wages was more than in any other five years of rising prices.

Then came the post-war depression of 1921. Unions lost membership, wages declined, and the hours were lengthened slightly. Until the beginning of the 5-day week drive, there was practically no further gain in leisure. Wage losses were finally won back, but the wage level has not yet risen above the 1920 high.

In fifty years altogether, workers have gained 15 hours leisure per week, and increased their buying power $13 a week; hours of work have decreased from 63 a week in 1880 to 48 a week in 1930; wages per hour increased from 19 cents in 1880 to 72 cents in 1929. Buying power of average wages in terms of 1929 dollars, increased from $18.80 to $34.75 in 1929.

Present Condition

The present organization structure shows that for the fiscal year ending August 31, 1931, there was a total membership of 2,889,550. This membership is distributed among 28,229 local unions in the 105 national and international unions with a membership of 2,875,019, and 334 local trade and federal labor unions directly affiliated with the American Federation of Labor with a membership of 14,531.

Today, as the 50-year-old Federation faces an era of depression and changing

conditions, it has two of the most significant and perplexing problems in its history to deal with: wage reductions and unemployment.

The American Federation of Labor firmly believes that maintaining wages is a preventive measure. "Workers' buying power must be maintained so that the demand for goods will be kept up and employment may not fall to any lower levels. It is essential also to maintain the American living standard, for wage levels recover slowly. The wage liquidations of 1921 retarded workers' progress by more than eight years. For by 1929, wage earners had not entirely regained the 1921 losses."

"Falling wages have an effect on business comparable to falling prices. Falling prices start a competition in price reductions, each firm trying to secure business by cutting prices a little below others. Thus, the price is driven down, in some cases even below production costs. At such times purchasers hold back their orders as long as possible to take advantage of the lowest price. Wage reductions would start a toboggan slide of wages similar to prices in the last year and a half. Though wages were reduced below the minimum living standard, customers would still put off their orders to wait for further reductions. Both commodity and labor markets would be thoroughly disorganized. Such a policy would retard business recovery."

A. F. of L. Program

To meet the crisis that is expected to be created by at least 7,000,000 people being unemployed this winter, the Federation advocates, besides the maintenance of wages, the following program:

1. *Shorten work hours.*

Dividing work hours will provide work for more men.

2. *Assure employment to minimum work forces.*

By assuring employment to minimum work forces some 20,000,000 wage-earners could plan their purchases with confidence over a definite period.

3. *Each employer take on additional workers.*

If all employers were to take on an average of two workers each, all but 1,000,000 of the unemployed would be given work.

4. *Create work through public building.*

It is estimated that work was created in 1930 for 75,000 men in public building in addition to those already at work, and for 150,000 men in the industries supplying materials for this work. If every effort be made to create work through public construction this coming winter, it should be possible to give work to over 100,000 in addition to those now employed.

5. *Strengthen employment agencies.*

Attention should be concentrated on building up the present system of employment bureaus and supplementing it where necessary. Local communities must undertake the main effort, but the federal and state governments can support and encourage, and undertake the essential function of coordination, putting local bureaus in touch with needs in other parts of the state or country.

6. *Keep young persons in school to prevent their taking jobs from older men and women.*

Every effort should be made to keep boys and girls in their teens in school. Not only will their efforts to secure work take jobs from older men and women, but they will find it difficult to get work.

7. *Give preference to workers with dependents.*

Employment should be given workers whose wages must maintain dependents. Fathers of families and workers who must support dependents should have prior consideration when additional employees are needed or when personnel is being reduced.

8. *Give financial relief from public and private funds.*

Without question there will be millions this coming winter who will depend for existence on charity. Funds should be used primarily to furnish work rather than relief work wherever possible. The collection and administration of funds for relief purposes is of utmost importance to Labor, and Labor, with other groups, should be represented on boards responsible for this work.

TWO LEADERS IN THE A. P. S.

George Edwards, of New York, past Supreme President, and Frank Seavier, of San Francisco, who is slated to be the next president

The I. A.'s Record

The affiliation of what is now the International Alliance of Theatrical Stage Employees and Moving Picture Operators of the United States and Canada with the American Federation of Labor has been a long and active one. Chartered by the Federation July 20, 1894, as the National Alliance of Stage Employees, the organization retained this title until September 25, 1902, when, at the 10th annual convention, "General Secretary-Treasurer Lee M. Hart addressed the Convention on the necessity of the National alliance making application to the American Federation of Labor for a change of name and charter from a National Alliance to that of an International Alliance of Theatrical Stage Employees."

Following Mr. Hart's address, a motion was unanimously carried to have the American Federation of Labor change the name of the National Alliance to that of an International Alliance of Theatrical Stage Employees "with trade rights of all theatrical mechanical work and construction that in any way has to do with the successful production and rendering of any theatrical or operatic entertainment."

Except for the issuance of a duplicate charter in 1912, there were no changes in the title of the International Alliance of Theatrical Stage Employees until 1929, when the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators superseded the latter organization.

The strength and interest of the I.A. T.S.E. in Federation affairs is concretely demonstrated by an inspection of the table of voting statistics of the affiliated unions of the American Federation of Labor. For the years 1923 up to and including 1931, it is shown that the International Alliance of Theatrical Stage Employees and Moving Picture Operators of the United States and Canada, now ranks 32nd in voting strength among 107 organizations, and that since 1923, the I.A.T.S.E. has shown a very favorable standing, while other groups have failed to progress or retain the growth they had once obtained.

FROM FOREIGN FIELDS

New French Devices

A PROJECTOR provided with a means for directing air on the film during projection. Three nozzles blow air on the film at the gate and on each side thereof. . . . A film splice for repairing breaks in films. The two ends of the films are cut to form convex and concave ends, which are overlapped and cemented together. . . . A system synchronizing an orchestral accompaniment and motion pictures, which includes a separate film, synchronized with the picture film, having notes on it which may be read by the orchestra leader. . . . A sound film on which the area for sound is indicated by a tint, or the like.

A projector that will allow better sound production by eliminating vibration, and do away with intermittent motion of the film. Called the "Universal" projector. . . . A four-color process in which a beam splitter is placed behind a revolving filter carrier. The revolving carrier has two different filters which are alternately in the beam. The beam splitter has two different filters in the two beams, thus providing four different filter combinations.

New English Devices

AN apparatus in which, while one or more films are being projected, the parts of the same films that have already been projected or other films are being rewound. . . . A reflecting device which laterally reverses the projected image provided in the beam of a projector having in combination with it a sound reproducing unit using a photographic sound record on the film. Projection from the rear of the screen without changing the position of the film is thus accomplished. . . . A projector provided with electric contacts normally held open by the film and by a belt transmitting motion to the film feed mechanism. Breakage of either the film or the belt will cause the projecting lamp to be extinguished, the lights in the theatre switched on, and the motor stopped.

A method of sound picture production which comprises an acted performance concurrently with a phonographic rendition of the sound part incident to the performance. The photographic and sound apparatus being perfectly synchronized. The sound record used may thus have been prepared by any desired person or musical organization.

New German Devices

A PROJECTOR provided with a driving mechanism which converts continuous movement into intermittent motion; brought about by a particular form of chain drive. . . . A projector in which the film runs continuously except at oscillating gate, where movement of film is intermittent. The speed of the movement during the period of motion is faster than the movement of the film at take-up sprockets. . . . A safety screen made of a sheet of glass containing on its surface positive or negative cylindrical lenses. . . . A projector case which may be opened up and contains a screen at one end.

An optical means in a sound projector for picking up the sound irrespective of the location of the sound track on the film. An arrangement which avoids fringes in the projection of color pictures by a process using lenticular films. . . . A support for a camera to allow the camera to be shifted to different positions for taking two successive pictures for stereo purposes. . . . A method of printing sound records on narrow film which includes perforating the narrow film to correspond to the wider film. . . . A projector in which, when one film is exhausted, the end of the film is automatically attached to the trailer of the exhausted film and threaded through the machine.

Russian Color System

NIKOLAI ANASHIENKO, Russian inventor, is reported to be working on a new system for colored pictures. The idea is claimed to be a radical innovation but at present is being held back because of the presence of flicker in reproduction. Anashienko's method employs a revolving disk and two filters. Pictures are photographed through a single lens and the camera with all associated apparatus is not in the least complicated.

Wage Scales Abroad

AS a result of intensive agitation, French projectionists have secured an increase in salary. Theatre projectionists have agreed to take 230 francs (approx. \$9) a week for theatres opening three times a week, and 550 francs (approx. \$21.50) a week for a six-day week. Each supplementary performance will be paid for at a rate of 50 francs (approx. \$2) per time.

Theatre operators in Mexico are also having their troubles these days as a result of projectionists forcing the closing of houses when their wage demands were not met. The owners replied that the existing rate of wages was already too high: 18 pesos (approx. \$8) a day for first-class men, and 12 pesos (approx. \$5) for assistants. These figures, while not high for projection work, are regarded as "big money" in Mexico where the average family income is about \$25 weekly.

German Sound Installations

THERE were 1,132 Klangfilm, Tobis, and Gaumont reproduction machines installed in German cinemas by October 1, 1931. Of this number 561, or 49 per cent, were with single projector and 571, or 50 per cent, were with double projector. Of the total number 322, or 28 per cent, were of the film and disk method; 762, or 64 per cent, were film only; and 48, or 4 per cent, were disk only. Forty-five per cent of the total number of machines are of the sound on film type with single projector. These are installed chiefly in small-sized houses, of which there are a great number in Germany.

'Something from Nothing'

A METHOD of producing "sound out of nothing" by drawing and photographing a sound track has been perfected, after many years' experiments, by Rudolph Pfenniger, of Emelka. The sound track along the side of the film is artificially drawn and then photographed, the results being similar to those of the sound recording apparatus. This method will be employed in the Emelka sound short "Die Tonende Handschrift" ("The Sounding Handwriting").

Superimposing Film Titles

ACCORDING to a report from Oslo, Leif Eriksen, of the Norweigian branch of an American company, has invented a process for superimposing titles on film. A great improvement has been brought about by this invention, it is stated. Eriksen has patented his method, but has not as yet disposed of the patent rights. It is understood that the process consists of printing the titles on the film with a certain acid so that the printing appears in white, showing in white on the screen also. Of course, the film can be run through the projector in exactly the same way as before, as the printing does not interfere with it in any way.

Our British Friends

Dear Mr. Finn:

May I impose upon you by asking you to extend, through the medium of INTERNATIONAL PROJECTIONIST, to our brother craftsmen in America and throughout the world the best wishes of the officers and directors of the Guild of British Kinema Projectionists and Technicians for a very prosperous and happy New Year? At the same time I should like also to express the thanks of this organization to American projectionists for doing in such splendid fashion so many worthy things which have been of such great help to us here in England.

STANLEY T. PERRY,
President, Guild of British Kinema Projectionists and Technicians.

NOTES from the SUPPLY FIELD

NEW ATTACHMENT SOLVES SHIMMING PROBLEM

Non-shimming apparatus has been available for some months now, yet we have received recently many requests for information relative as to how best to overcome this problem. The apparatus herein described may be secured from International Projector Corp., New York, which company designed and manufactured this unit following the recommendation of the Projection Practice Committee of the S.M.P.E.—Editor.

SHIMMING has been a very serious problem since the introduction of sound reproducing equipment, but is only prevalent in connection with that equipment known as the D-Spec. attachment. This was the first attachment made and consideration was not given at that time to the varying tolerances allowed by the manufacturers of the projector prior to the advent of sound-on-film.

It was pointed out that it was not necessary to machine rough castings to which nothing was to be attached when projecting silent pictures, but great difficulty was experienced when sound attachments were added to these unmachined surfaces. It became necessary to use shims running all the way from one-eighth of an inch down to one-thousandth of an inch on the several corners of the mechanism in order to properly line up the projector mechanism with the sound equipment drive.

Great Time Loss

Obviously, where a breakdown occurred during the running of a show, several hours or more would be required to adjust a mechanism. Since the majority of theatres in this country are equipped with only two sound-equipped projectors, it meant that the theatre where the breakdown occurred would be left with only one projector to run the show, until the repair on the other projector had been completed. This, in turn, made it impossible to give a smooth performance.

The matter of solving this difficulty was put up to the manufacturers of both sound equipment and projectors; and an attachment has now been developed which eliminates the necessity for shimming. This attachment is entirely flexible and by its use the difficulty of replacing mechanisms on this very old-type sound attachment is entirely surmounted, so much so, that mechanisms may be readily changed within fifteen or twenty minutes.

For D-Spec. Equipment

Figure 1 shows this new attachment. It is only necessary to remove the gear retaining yoke from existing D-Spec. attachments and replace it with the new yoke and idler gears shown in the picture. This yoke is self-centered on the driving spindle for the projector mechanism, and it is only necessary to insert the spindle in the bearing and push it through into the hole provided in the mechanism to receive it. The yoke is then securely locked on the frame of the sound attachment and the bracket carrying the idler gears is then so adjusted as to eliminate lost motion between the gear teeth and the driving unit. The idler gear bracket is then securely locked in place by means of lock nut M.

Attachment Method

Figure 2 shows the assembly dismantled. At A is the flywheel always provided with the sound attachment; this is readily removed by taking out three screws. At B are the lock nut and washers for attaching the new yoke to the sound attachment; at C are the driving gears connecting the mechanism through the idler gears G and H to the main driving gear on the sound unit; at D is the spindle which slides into the hole M in the mechanism and upon which the assembly C revolves; at E are the three screws for attaching protecting cover L after unit is assembled; at F is the self-aligning yoke which carries the idler gear assembly; at G and H are the idler gears; at J is the adjustable bushing to take out end play in assembly C; and at K is the adjustable idler gear bracket.

No shimming is required when this new attachment is used, regardless of the age of the projector on which it is mounted, and it is felt by the designers that this unit satisfactorily solves the problem of replacing mechanisms where the old type sound attachment is used. This attachment is now available from International Projector Corp.

Figure 1

Figure 2

NATIONAL CARBON COMPANY REDUCES PRICES

PROJECTOR carbons will be cheaper after January 1, according to an announcement of the National Carbon Co., and extra length will be added to one of the high intensity series. The new prices of the various sizes follow:

The 12 mm. x 8 SRA size has been priced at \$70 instead of \$75 per thousand; the 8 mm. x SRA will be reduced from \$95 to \$80 per thousand; and the high intensity 9 mm. x 20 will sell for \$245 instead of \$325 per thousand. Two inches have been added to the 13.6 mm. x 20 (now 22) high intensity carbon, the price of which will remain at \$400 per thousand. This size is extremely popular for high intensity work.

The new SRA series carbons constitute a major advance in carbon performance; while the introduction of the pre-cratered carbon has won the approval of projectionists everywhere.

DEVELOP A NEW PAPER LENS WIPER

THE Howland Company, Inc., of New York City, is reported to have developed a new paper lens wiper which is said to possess all the softness and smoothness of cloth, is not abrasive, and will clean a projection lens better than anything now available. Samples of the new project are not yet available, but private tests are said to have demonstrated conclusively the superiority of this new product.

Paper an Abrasive

Previous attempts have been made to utilize paper as a lens wiper but were unsuccessful because of the inability to secure any paper substance which did not act as an abrasive. Camel hair brushes have heretofore been exclusively used for brushing a lens.

A MODEL FORM OF PROPAGANDA FOR PROJECTIONIST UNIONS

George A. Yager

BUSINESS MANAGER, SALT LAKE CITY L. U. 250

TO begin any clear explanation of motion pictures it is well that you should understand that motion pictures are not really motion pictures at all, but a series of still photographs projected upon a suitable surface known as a motion picture screen. These still photographs, the approximate dimensions of which are $\frac{7}{8}$ by $\frac{3}{4}$ of an inch, are projected onto the screen at the rate of 16 or more per second. The sensation of motion in these pictures is made possible by two facts: first, the rapidity with which they succeed each other upon the screen, and second, the persistency of vision.

Persistency of vision is that quality of human sight through which the vision of an object is retained by the eye for an instant after the object is removed from sight. Due to this quality it is not only possible but a fact that 16 times every second the motion picture screen is in total darkness, that is, there is no picture being projected upon it. This period of darkness is caused by the interruption of the light rays from the projector by what is known as a shutter and which resembles, in appearance, the wheels which are used on the parade wagons of a circus, in that they have alternate spaces of solid material and spaces which are punched out.

Light Sources

In the early day of the motion picture industry one of the greatest difficulties that had to be overcome was the perfecting of a suitable light source with which to illuminate the screen. An ordinary light would not do for the reason that the source itself has to be of very small dimensions; and in the beginning of the present century the only known method of obtaining a light of any intensity was the electric arc which at that time was available only in a very crude form.

The carbons which are used in an arc lamp to burn steadily and without flutter or flicker must be of uniform density throughout. Carbons themselves are made through a manufacturing process by which carbon, lamp-black and water glass, or silica, are combined. The lamp black and silica are used merely to hold the particles of carbon together. In some of our modern carbons there is a special inner core which is treated with various chemicals in order to improve the quality and quantity of light. Other forms of modern carbon are coated with copper in order to reduce their size and at the same time make them burn at the same rate as the larger uncoated carbon, which works with them. The reduction of size of the copper-coated carbon is for the purpose of increasing the amount of light from the other carbon by reducing the size of the shadow cast by the copper-coated one.

Dr. Sapington of the National Safety Council advises me that lead has been discovered as an impurity in the copper-coating of carbons and that lead poisoning is a possible vocational hazard of projectionists. In the early days of the industry 30 amperes current was about the maximum amount used on a carbon arc. However, with the passage of time

and modernization of theatres the amperage had to be increased along with the increased amount of auditorium light in theatres. Some of you may be able to remember the early motion picture theatre which was in total darkness during the screening of a motion picture, except for the light which was reflected from the screen. Nowadays a modern motion picture theatre is so well lighted during the screening of a picture that it is possible to read ordinary newspaper print during the screening.

Early Equipment

The early motion picture projector was a very crude and simple affair, having very few adjustments and a minimum of working parts. The entire roll of film was exposed all during the course of its screening, and in case of fire there were absolutely no safety devices to stop the spread of flames to the entire reel. No reel was provided for the film to be wound upon after it ran through the projector. Instead, the film was permitted to run into an open sack at the base of the projector. This greatly increased the fire hazard, and it is quite common to find old time projectionists whose bodies are literally covered with the scars of burns received in the early days of the industry.

In a great many cases the projection room itself was built of wood or other inflammable material, was of very small size, and located directly above the box-office of the theatre. Many times the projection room or booth, as it was called in those days, had as the only means of entrance a trap-door in the floor, and in many instances the cashiers, to avoid being bothered by the operators, who sometimes needed a glass of cold-water, fastened the trap-door on the outside which imprisoned the operator in the booth; and in case of fire he was literally burned alive. There are still instances where operators are burned alive in operating rooms, a member of the Provo (Utah), local union having a fatal accident of this kind only four years ago. I will quote part of an affidavit from an usher in the theatre who was the first one to enter the operating room after the fire was over, to give you some idea of how a man looks who has been burned in a film fire:

"I was the first one to reach the scene of the accident, being attracted to the projection room by an explosion. As I remember, the accident occurred about 8:00 p.m. I rushed to the projection room and found it full of smoke. When I got there the door was closed and I could hear shouts from within calling 'Help! Help! I can't see.' Graham managed somehow to open the door just as I reached for it. I rushed into the room and as I faced him I could see he was burned from head to foot. His clothing was burned from his body and he kept crying out that he couldn't see. I took my coat off and put it around him but he threw it off crying that he couldn't stand it. By this time he was burned beyond recognition. I finally succeeded in getting my coat around him and, with the help of an usher, took him downstairs to Dr. Arnold Robinson's office which was adjoining the theatre."

Physical Hazards

You will note that the usher speaks of the room being full of smoke. What he refers to as smoke was actually nitrogen-oxide fumes. Again quoting Dr. Sapington, who says in part:

Exposure to apparently trifling concentrations (of nitrogen-oxide) may lead to profound edema of the respiratory tract. The word "edema" refers to swelling in the lungs and the respiratory passage because of the inhalation of nitrogen-oxide fumes. This swelling is so great and is so sudden in many instances that it causes internal suffocation. Carbon Tetrachloride is used in fire extinguishers in projection rooms because of the fact that it is a non-conductor of electricity, but when carbon tetrachloride is played upon burning film is creates a very dangerous gas by combining with the nitrogen-oxide gases formed by the burning film.

These fumes lead to inflammation of

the respiratory tract, to pneumonia, to narcosis, and if the exposure is prolonged, to degeneration of the liver, along with nephritis. Of course, you all know what pneumonia is. Narcosis refers to the condition of being overcome by exposure to the gases generated when carbon tetrachloride is used as a fire extinguisher. The word "narcosis" is applied to any condition in which there is a loss of consciousness because of the toxic effects of various gases and liquids; we speak, for instance, of "chloroform or ether narcosis" for an example. Nephritis is Bright's Disease or a definite inflammatory process in the kidneys. Other very definite vocational diseases of commoner occurrence but less direct in the production of physical impairment are:

1. Damage to the eyes from the intense glare of light reflected from the surface of the motion picture film, at times direct exposure to intense light.
2. Excessive temperatures.
3. Frequently, but not always, continuous poor ventilation, even in theatres in which ventillating systems are installed.
4. Lead-poisoning, which has already been referred to.
5. Tuberculosis, caused by the inhalation of the fumes from burning carbons, which transmit free silica in large quantities to the projection room unless piped from the room by forced draft.

I have a copy of an industrial award from the state of Wisconsin in which it is definitely shown that these conditions are occupational diseases of moving picture machine operators.

Safety Measures

Motion picture film, as it is commonly called, is in reality nitro cellulose and is made from gun cotton. From gun cotton there is also made powder, dynamite, T.N.T., and other high-explosives. Yet film when burned in the open air will not explode, and should anyone tell you that it will, they are misinforming you. What causes an explosion when there is a film fire is the concentration of nitrogen-oxide gases which the film itself ignites when they have become dense enough.

That is another reason why proper ventilation should be provided in all projection rooms. You are all familiar with Kodak film and probably some of you have experimented with it and know how inflammable this material is; yet you were only dealing with a very small piece; whereas in the modern projection room a reel of film is a ribbon 1 inch wide and approximately 1,000 feet long. The picture program of a modern theatre may run to as high as 12 or 16 reels which, as you will perceive, makes available in the room to be eaten by flames from 12,000 to 16,000 feet of film.

Should you ever be in a theatre when a film fire breaks out, do not attempt to leave your seat until requested to do so by the management, and then proceed in a slow and orderly manner. A modern theatre is so constructed that there is no danger to the audience from a film fire itself; however, a great many people are injured in the stampede which goes along hand in hand with the panic occasioned by some foolish person in the audience yelling "Fire!"

Prior to the introduction of sound pictures there was only one motion picture operator on duty in the operating room at a time; but with the introduction of sound pictures two men were placed in projection rooms. There are numerous duties around a projection room which take a man from the side of his projector, if he is alone in the room. That is the reason why the members of our Union insist that two men be on shift at all times, so that not only the operator himself is properly protected from the fire, but the entire audience as well.

The fire hazard has increased since the introduction of sound for several reasons. Among these are a more intense and therefore hotter light concentrated upon the film so that a picture of the same briliancy could be obtained on a screen which is about 30 per cent transparent

as was formerly obtained upon an opaque surfaced screen; also there is more wear on the film by the introduction of two more sprockets in the sound mechanism of the projector, and increased projection speed in some cases which adds to the wear of the sprocket holes on the film.

Sound Pictures

Motion pictures with sound are made possible by the combining of discoveries, some of which are older than moving pictures themselves. For instance, transformers or repeating coils, as they are called by telephone men, are much older than motion pictures. You have seen transformers, those big black boxes which hang at the top of power poles and which are used to change electric current from one pressure to another, or one voltage to another.

Other things which have made sound pictures possible are photo-electric cells, or electric eyes as they are sometimes called, which very much resemble an ordinary radio tube and which work much the same as a tap in a water pipe, except that they are turned on and off by light rays and when they are turned on they permit an electric current to flow in a circuit instead of water flowing through a pipe. The mechanical features of sound picture apparatus involved nothing that was not already known to everyone in the industry. They simply needed to be adapted to their new uses.

A modern sound picture installation looks very much like the panel board in a broadcasting station. There are two methods used for recording sound pictures; the sound-on-disc method and the sound-on-film method. Sound-on-disc, from a mechanical standpoint, is not however, faithful reproduction of sound is possible over a wider range of sound frequencies with discs than with sound-on-film.

Labor Organizations

In the early days of the industry the motion picture projectionist had not yet been organized into labor unions, and as a consequence he labored long hours in projection rooms, which at that time were called booths, and under conditions which were deplorable. The pay was low. There were no facilities for sanitation or ventilation.

As the industry grew and a better type of man was attracted to our profession they were organized into the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators of the United States and Canada. Prior to this time the stage employees were the only craft represented by this international union. Today all branches of the industry are served by members of the international union and we now have, in addition to the stage employees and moving picture operators, studio mechanics, motion picture cameramen, still photographers, laboratory workers and sound technicians. So, all technical departments in both the producing and reproducing sections of the industry are served by members of our unions.

RCA Portable Reproducer

This unit comprises a projection machine, an amplifier, a loudspeaker and a carry-case for film and these have an aggregate weight of slightly more than 200 pounds. The projection machine is 19″ high, 19″ wide and its breadth is 10″. The amplifier, which is built in a carry-case having a removable cover, is 26″ long, 8¾″ high and 11″ in breadth. The loudspeaker, which is of the flat baffle type, is contained in a carry-case, the dimensions of which are 8½ x 19 x 14″.

Standard 35 mm. film is used and adequate sound reproduction is obtainable in a room or hall having a content of 75,000 cubic feet when using the 8-inch directional baffle. A 6-inch dynamic cone speaker is supplied when the cubic content does not exceed 12,000 feet. A picture about 8 x 10 feet in dimensions is obtained upon the screen from a throw of 75 feet. The equipment is AC-operated from an outlet of 105 to 125 volts, either 50- or 60 cycle, single-phase power source.

International PROJECTIONIST

Edited by James J. Finn

In This Issue:

TESTING CIRCUITS

A. C. Schroeder continues his series of articles on the proper methods of testing electric circuits. Practical data prsented in practical fashion by a practical projectionist.

LAMP EQUIPMENT

Pertinent comment on correct lamp equipment and approved methods of operating technique by R. H. McCullough, Fox West Coast projection director.

EMERGENCY HOOK-UP

A novel means employed by M. D. O'Brien, Assistant Director of Projection, Loew Theatres, to keep the show going.

D. C. POWER SUPPLY

A timely and provocative analysis of D. C. power sources by Samuel Bagno. Rebuttal comment by experienced workers in the field.

—and Other Articles

NEWS and VIEWS — TECHNICAL HINTS
DIAGRAMS — NEW EQUIPMENT

Vol. 1, No. 4
February, 1932

A magazine devoted to better visual and sound

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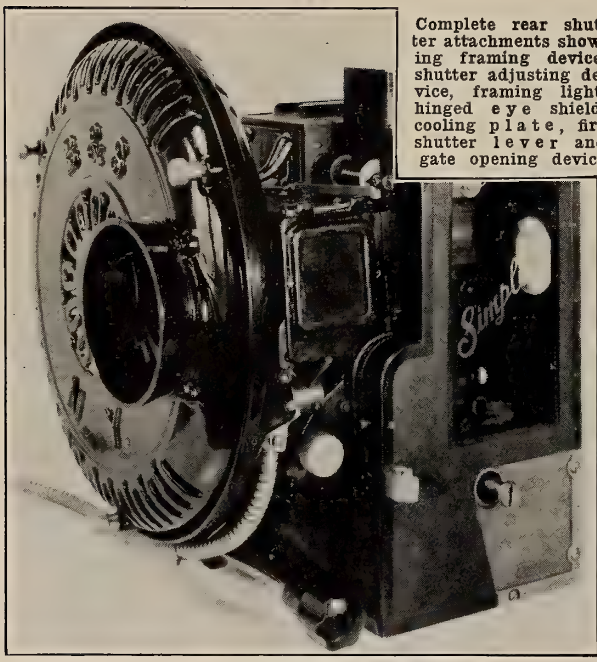
TWO NOTEWORTHY ACHIEVEMENTS IN PROJECTION EQUIPMENT



Complete rear shutter attachments showing framing device, shutter adjusting device, framing light, hinged eye shield, cooling plate, fire shutter lever and gate opening device.

New Low Price: $85

B. & S. Rear Shutter

reduces aperture heat by 70%, minimizes effect of warped and buckled film, and keeps film free from dust and dirt. Exclusive blade feature of this shutter keeps hot air from film and insures constant supply of cool air around the aperture. The results of a test by the Massachusetts Department of Public Safety in a Boston theatre on January 19, 1930, are as follows:

Without B. & S. Rear Shutter
Aperture Heat: 1250° F.

With B. & S. Rear Shutter
Aperture Heat: 340° to 350° F.

Installation can be made in one hour on any single- or double-bearing projector mechanism, without any cutting or drilling. Periodic oiling is the only maintenance requirement. Rear shutter equipment includes cooling plate, framing device, shutter timing adjustment, and a framing light. A hinged eye shield permits easy accessibility to the mechanism.

B. & S. Change-over

consists of two shutter blades contained in a housing designed for attachment to the cone of the lamphouse and operates on either A.C. or D.C., at 110 to 125 volts. Novel design eliminates any possibility of double exposure on the screen, and makes the change invisible to the audience. B. & S. Change-overs operate efficiently on either A.C. or D.C., but coils for the proper current will be supplied on specification. Coils of the B. & S. Change-over will stand up under heavy overloads and will not burn out.

The constant arcing in an ordinary change-over switch soon causes the metal contacts to burn and corrode. All B. & S. switch contacts are made of carbon that cannot corrode. B. & S. unique design also prevents the flash from touching any part of the switch. This switch cannot stick or bind and is positive in operation. B. & S. Change-overs have been used for many years in Publix, R-K-O, and other major theatre circuits.

Write for particulars to

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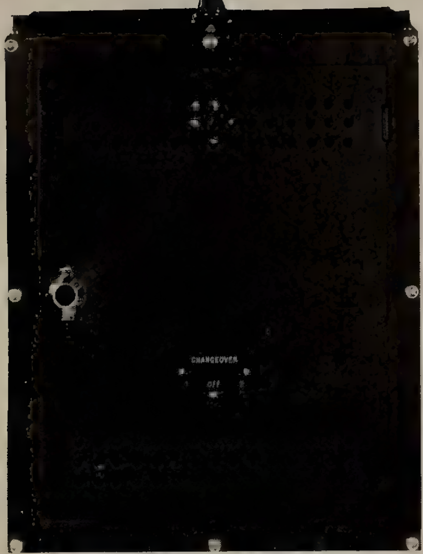
For fifteen years manufacturers of high grade motion picture equipment

749 EAST 32nd STREET, BROOKLYN, N. Y.

PRL SOUND SYSTEM

TYPE 9-AC



A Complete All A. C. Operated Theatre Amplifier
For Sound-on-Film Reproduction

THE type 9-AC Sound System is designed to meet the requirements of all theatres having a capacity up to 1,200 seats. This unit, as illustrated above, is a complete and self-contained power supply and high-gain amplifier designed especially for sound-on-fi.m reproduction and constitutes the entire electrical apparatus necessary between the P. E. cells and the stage horns.

Being comparatively small, this unit is placed between the two projection machines, connections to the P. E. cells, exciter lamps, horns and A. C. line being brought in to a marked terminal strip through knockouts provided in the sides and bottom of the cabinet. In addition to supplying the current for the P. E. cells, this unit is equipped with a new type transformer which supplies the current to the exciter lamps *without the aid of filtering*.

For convenience and simplicity of operation the controls are placed in the top and front of the cabinet. These include a volume-control and sound change-over switch. The amplifier and all apparatus is mounted on a steel panel as shown at the right above. This feature makes it possible to remove the entire assembly from the cabinet without disturbing the conduit connections from the cabinet to the sound heads and other apparatus. This permits quick inspection and facilitates servicing.

The unit, as a whole, is substantially built and presents a very pleasing appearance. Only the finest materials obtainable are used and all parts are standard and interchangeable.

Specifications:

VOLTAGE GAIN	90 DB
NUMBER OF STAGES	4
TUBES REQUIRED	1-224, 2-227s, 2-250s, 2-281s
POWER OUTPUT	15 watts
INPUT IMPEDANCE	Caesium photocells
OUTPUT IMPEDANCE	Three 15-ohm lines
P. E. CELL CURRENT	90 volts
EXCITER CURRENT	Up to 10 volts at 8 amperes
FADING SYSTEM	Exciter change-over
POWER SUPPLY REQUIRED	110 volts, A. C., 50-60 cycles
POWER CONSUMPTION	300 watts
SIZE OF CABINET	20 in. x 16 in. x 9 in.
NET WEIGHT	55 lbs.

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MONTHLY CHAT

MOST important among recent developments in this field is, as we see it, the substantiation of our time-worn argument that in any proposed change of standards the theatre should receive first consideration. The activity incident to the introduction of a new aperture standard leaves no room for contrary opinion on this topic. The proposed new standard was ballyhooed by studio technicians as representing truly "artistic proportions." With this statement we are in accord.

When it came time to establish these "artistic proportions" upon the screens of theatres, however, the sponsors found that there is a very great difference between the artistic ideal and the technical necessities of picture presentation—not to mention certain economic considerations which, we admit, have no rightful place in the sphere of "art."

To make a long story short, it has been conclusively demonstrated that production must take second place to exhibition, and, further, that the only worth while motion picture god is the fellow who walks up to the box office and lays down the price of admission—for which, don't you think? he must be given full value in good pictures properly presented.

JUST when we thought we had bested our major problems, along comes a new headache. Projectionists who are now afflicted with those very efficious theatre managers who insist that carbon consumption is much too high, will soon have to deal with this trouble in aggravated form. For (it breaks our heart to have to tell it), a plan is afoot to attempt through the medium of a magazine to educate the heretofore uneducationable manager in projection matters. Which means that very soon the manager will be able not only to intimate that carbon consumption is too high but to go right into the projection room and *demonstrate*. Pocket size, of course, so that the manager can stick it into his tuxedo coat pocket. Full details later. Projectionists will appreciate this further aid in their work.

THE big news within the next month will be Western Electric's announcement of a greatly improved recording and reproducing process. The frequency range is to be "extended" and merely good sound reproduction will not be acceptable in the future. Of course we've scooped all our colleagues on this little announcement, but since our scouts have picked up only the outlines of the process we shall have to be content and await the formal W. E. announcement next month.

INTERNATIONAL PROJECTIONIST

VOLUME I NUMBER 4

FEBRUARY 1932

FUNDAMENTALS OF TESTING ELECTRIC CIRCUITS

A C. Schroeder

MEMBER, I. A. LOCAL UNION 150, LOS ANGELES, CALIF.

II

IN figure I is shown a simple two-wire circuit. It is surprising how many things can happen in such a circuit and the different methods that can be used in testing it. The use to which this circuit is put often has a large bearing on the test and in interpreting the results of it.

Assume that the drawing represents a line carrying 110 volts and that the end at A is connected to the source of supply. The wires at B go to the device that constitutes the load, but for the present we will assume that it has been disconnected by opening a switch. Near the end B are two fuses.

Both wires should be continuous from A to B, that is, if nothing is wrong. For the first test we place the leads from a test lamp across the terminals of the fuse block at the end nearest B. If the lamp lights, it is an indication that current is flowing through the lamp and that it *probably* is coming from A. This might sound like a queer statement, but the fact that the lamp lights when connected to the end of the line at B is not *positive* proof that the line is continuous.

The line could be broken, as at X in Figure 2, and if there is a circuit of some kind around the break, as shown by the dotted line, the lamp will light. It is true that such a condition is not very apt to occur in a line such as we have under discussion. It is, however, not at all unlikely to happen in an amplifier or its associated apparatus, with the usual result of noisy operation or possibly one or more tubes working at a wrong voltage, etc. The condition that is not likely to happen is the one that stumps the man who does not take all the possibilities into consideration.

As a rule it can be taken for granted that the current is coming from A when the test lamp lights. If any doubt exists (and it must be established if this is so), simply opening *both* sides of the circuit at A will establish the fact. If this causes the lamp to go out, it shows that A is the source of power; if the lamp remains lighted, the current must be coming from some other place. Figure 3 shows how such a condition might occur. We have a line from A to B as before, but it is broken at X-X and two wires are brought down to C where they are connected to a different power supply.

Suppose that the lamp does not light. The next step will be to see that the test circuit is O.K. Place the test lamp across a circuit that is known to be in good condition. This can be done by testing across the fuses that connect to the projection room lights, the amplifier circuit, or somewhere in the circuit between the motor generator set and the projection arc. If the projection room lights work, if the amplifier is lighted, or if the arc is lighted, we know that these circuits are O.K. Should the test lamp light when put across any of these, it shows that our test circuit was in good shape and that the current was not getting to point B in the line we have under discussion.

If it is shown that the test circuit is at fault, we try another lamp, one that has been working somewhere, or we can take the lamp out of the test circuit and try it in a socket in which a light has been burning. If the lamp was in good condition, the trouble is either a broken wire, or the lamp was not screwed down in the socket.

Now that the test circuit is O.K., we again test at B. Suppose that we still do not get any indication of current. The test terminals are then placed across the

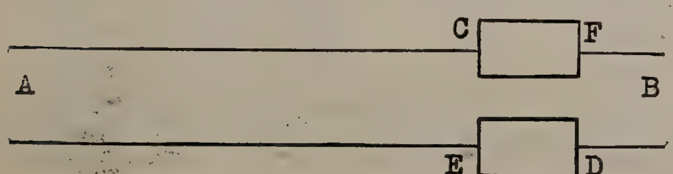


Figure 1

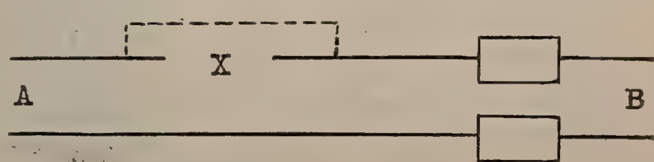


Figure 2

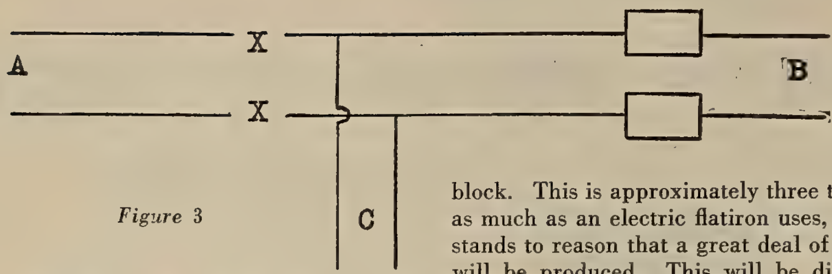


Figure 3

other end of the fuse block, the end farthest from B, and we find that the lamp lights here, which shows that the trouble is either in the fuses or in some part of the fuse block. One wire from the test lamp is then touched to C (Fig. 1), and the other wire to D. If the lamp does not light, it shows that the lower fuse is probably blown.

Ninety-nine times out of one hundred it will be the fuse; but we must bear in mind that it is possible for the trouble to be in the fuse receptacle. If the lamp lights when this test is made, it shows that the lower fuse and the clips into which it fits are O.K., at least there is no open circuit, so the leads are touched to E and F. The results of this test are interpreted the same as the test from C to D.

Sometimes it is easier to locate the trouble by testing while the load is connected. Assume that the load connected to B in Figure 1 draws 100 amps. when everything is normal. At this particular time the apparatus will not function, so the switch is opened and the test lamp is placed across the end of the fuses at B, and the lamp lights, showing the fuses to be O.K. Since there are no other fuses between this point and the load, it is evident that something has gone wrong in some part of the apparatus or the wiring. It is convenient to start at the fuse block, so we close the switch, throwing the load back onto the line. Another test is made across the fuses at the end B and we find that the lamp does not light.

Let us analyze this condition to see just what happens. Our test lamp lights when the load is not connected; but when the load is thrown on, the lamp goes out. A test is now made across the fuses on the side nearest A and the lamp lights even with the load connected. When the load is hooked onto the circuit, the voltage across the B end of the fuses drops so low that the lamp will not light, which means that the voltage probably drops to about 20, possibly less than that. We found the voltage across the other end of the fuses still was 110, so the trouble must be somewhere in the fuses or in the fuse block. Subtracting 20, the voltage at B, from 110, the voltage at the other end of the fuses, gives 90, the voltage-drop in the fuse block.

Under these conditions there are about 1.800 watts of energy consumed due to the resistance somewhere in the fuse block. This is approximately three times as much as an electric flatiron uses, so it stands to reason that a great deal of heat will be produced. This will be discovered very quickly—in fact, if the circuit is left in such a condition, the fuses will blow due to the heat. The point is that heat is generated and can be found quickly by touching the parts—carefully, of course, as they may be very hot. It should be kept in mind that cartridge fuses having round ends that fit into the clips often run quite warm when 50 to 60 amps. are taken from the line. That is why fuses of larger capacity are made with the knife-type contacts.

Since we are discussing principles, and also because we cannot locate the exact point of the trouble by looking for the heated parts, we continue with the testing. Ninety volts is enough to light the test lamp quite well, so we test from C to F, in Figure 1. Nothing happens. This side of the circuit is probably O.K. Then the test is made from E to D and the lamp lights, not to full brilliance, but still quite brightly. Evidently this must be where the trouble is, because normally there should be no drop in voltage across these two points.

The test leads can now be placed on the ends of the fuse, as in Figure 4. The lamp probably will not light, since it is unlikely that a high resistance will develop in the fuse. Such a condition would cause the fuse to burn-out almost immediately.

Testing as shown in Figure 5, from the terminal screw to the end of the fuse, quickly shows on which end the trouble is, since the lamp is now across all the parts at this end of the block. If the lamp does not light at one end, the test is repeated at the other as a check, and if it lights, we proceed to dig deeper.

Test from the clip to the fuse (Fig. 5). If the lamp lights, we have found the trouble—a poor contact between the fuse and the clip. Continuing, one lead is placed on the part to which the wire is fastened and the other lead on the bare wire, as in Figure 7. High resistance caused by a loose wire or corroded wire is found by this test.

Figure 8 shows the remaining point to be tested. It will show if high resistance is present between the clip and the part next to it, the part with the screw in it under which the wire is fastened.

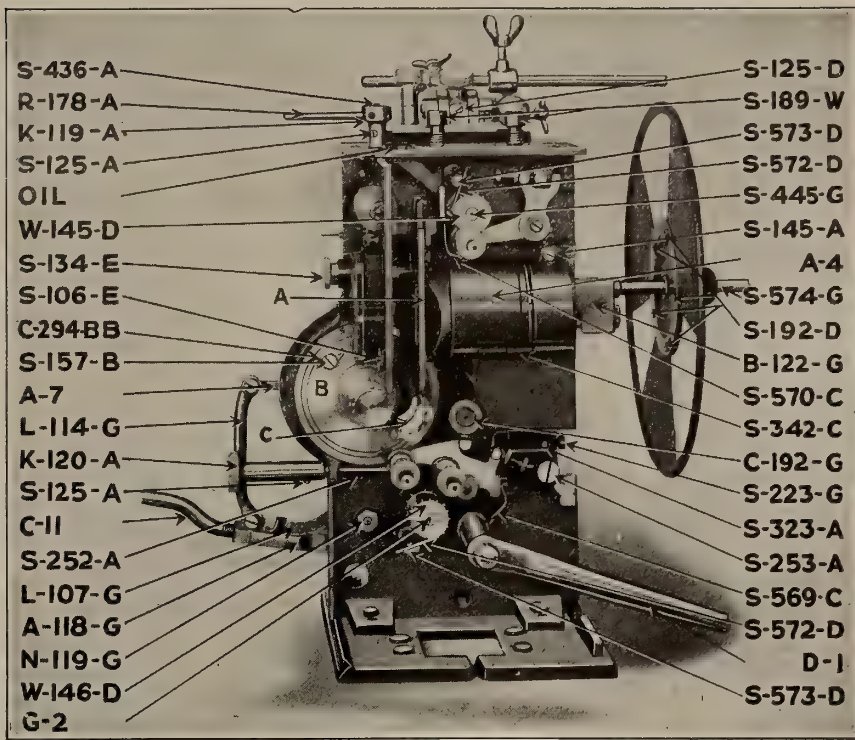
By this time it should be apparent that the idea is to get the test lamp across the part of the circuit in which the high resistance exists. The *exact* location can be found in this manner. Of course, it is not logical to start the search by testing every small part of the circuit, step by step. In a large and complicated circuit such a procedure would take a long time. A large portion of the wiring, etc., is eliminated in the first few tests. Let us go through some of the steps again, without going into details. The test lamp across B in Figure 1 showed a presence of voltage. Next, the load was thrown on and there was no voltage at this point, that is, not enough to light the lamp. Testing across A showed that the full line voltage was present. We have made three tests and have eliminated everything on the line side of the fuses and *probably* have eliminated everything from the fuses to the device we wish to operate.

One more test showed that the upper

fuse and the clips were not the seat of the trouble. We proceed to the lower fuse and it is evident that the trouble is right around this portion of the equipment. It is possible that the *exact* point where the trouble is has not been found after all the tests have been made as set forth. In such a case we must test across each piece of metal that was in the circuit when we made the test shown in Figure 5.

It sometimes happens that cracks and seams occur in manufactured articles. Suppose that one of the parts is cracked, possibly on the under side where it cannot be seen. One test lead is put on one end of the part, and the other lead on the opposite end. The lamp lights if the part is defective.

It is seldom that all the tests would have to be made as outlined in this article. The trouble will usually be found after a few tests are made. If the reader has gone over this carefully, he will have no trouble in applying the ideas contained here to other apparatus, such as switches, terminals on motors and transformers, low resistance windings, etc. As we go along we will take up other methods of making similar tests, and then tests on circuits of higher resistance and having other kinds of trouble.

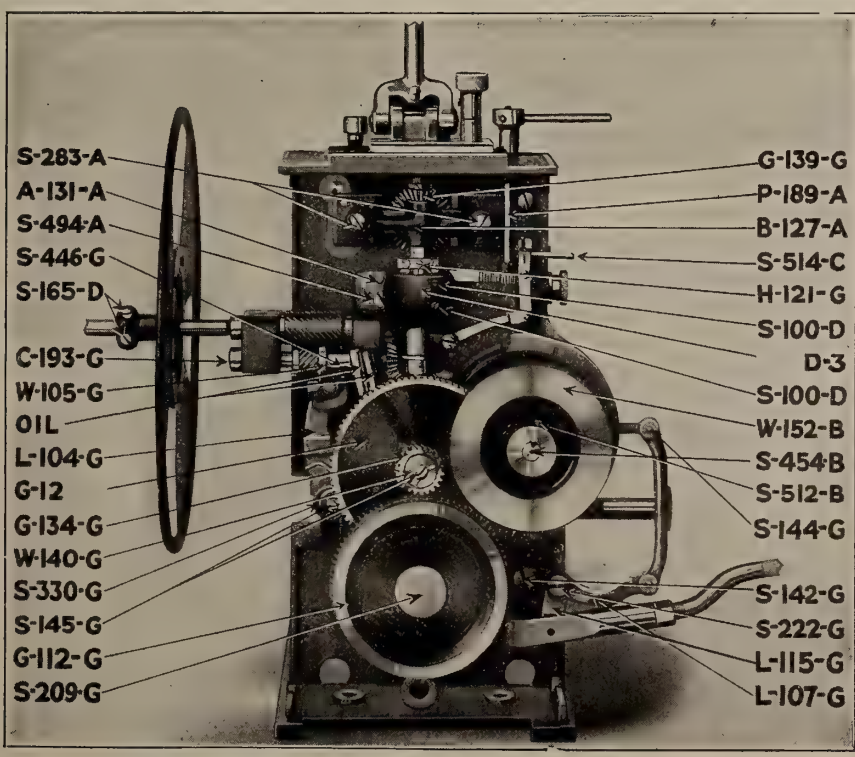


AN IMPROVED METHOD OF REMOVING INTERMITTENT

IN the days before sound pictures the changing of an intermittent mechanism on Simplex projectors offered no serious difficulty, and the job could be done quickly. Referring to the accompanying illustration, the procedure was as follows:

On the gear side of the projector, first remove screw S-209-G and then the main drive gear G-112-G. Then, on the threading side of the projector, remove collar C-192-G. Then, returning to the gear side of the projector, grasp the flywheel of the intermittent with one hand and the G-12 with the other, and pull both easily toward you. The intermittent thus came out (with the G-12). This process was reversed in replacing the spare intermittent, and the shutter was, of course, re-timed.

The attachment of sound reproducing equipment (in this case we refer to W.E.), meant the addition of a yoke and some extra gears to the projector which make it difficult for the projectionist to remove the intermittent quickly in an emergency, because he would first have to remove the yoke and the extra gears which are in his way. To follow the instructions mentioned above for this job would add from 15 to 30 minutes to the job.



At present the better procedure is *not* to remove G-112-G but to proceed as follows:

On the gear side of the projector remove screw S-145-G and washer W-140-G; then push shaft S-446-G through the gears G-1346 and G-12, being careful to hold these gears so that they do not drop sharply as they are disengaged from the shaft. The intermittent is then pulled carefully toward you and is out.

It is understood that prior to these operations the film trap is removed and the cover clamp C-294-BB has been turned away. The process is reversed when replacing a mechanism. Care should be taken to insure that the letter "O" on G-12 and on the intermittent flywheel are parallel. Thus shutter is, of course, re-timed.—J. M. RUGINO.

ALEOGRAPH VS. W. E.

The Aleograph Company has lost its appeal in its suit against Electrical Research Products, Inc., in which infringement was claimed against the Western Electric Sound System, according to information received recently from New Orleans. The patent in question, No. 1,494,514, is entitled "Art of Producing Motion Pictures and Sound Synchronized Therewith."

LIGHT AND LENSES

Victor A. Welman

A lecture given by Victor A. Welman before Cleveland Chapter No. 18, American Projection Society, on November 18, 1931, forms the basis for this article.—Editor.

THIS will be a talk on lenses, leaving to some future time a discussion of the modern theory of light and its propagation. The theory of light changes almost from month to month and it requires constant reading to keep up with the procession. It is safe to say that no ordinary reader can keep up with these developments.

The laws governing lens action, however, are well established and have been for many years. The principles to be outlined here can be found in a book[1] published in 1897 and which I studied in 1900—31 years ago. These dates should not surprise anyone, because the fundamental law governing the action of various shaped lenses were promulgated by Huygens about 1670, from which we can understand that it is not by any manner of means a recent development.

I cite the antiquity of this principle only to emphasize how unnecessary has been the widespread misunderstanding of lens action in the minds of many of those working with them, particularly among members of our own profession and, unfortunately, in most of the books published for popular study.

Misinformation

Figure 1 is a classic illustration to be found in almost all our books as illustrating the course of light waves in projection optics. This drawing is the source of most of the misunderstanding current on lenses. It is what can be properly termed a shorthand drawing—telling the true story if one knows how to read it. In its original location in a textbook, following the explanation of the Huygens construction, it is clear enough; but when lifted into the popular books without proper explanation it does not tell a true story.

Now let's get into the subject. We'll try not to be logical—which means that we shall try to make it interesting. It has been my experience that a logical presentation of a subject dried it out.

What is light? I answer, "I don't know." Dr. Miller doesn't know. Dr. Michaelson didn't know. Even Einstein doesnt' know. So, why should we worry about it?

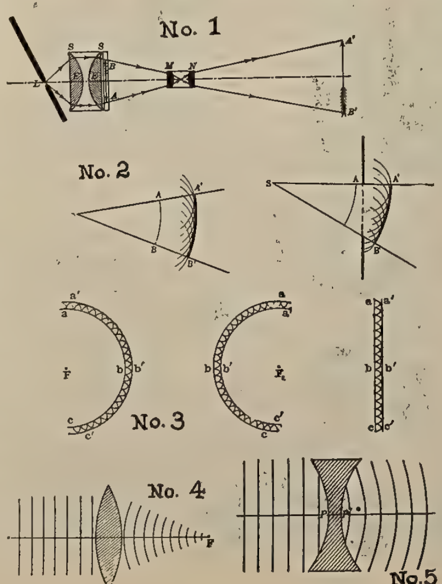
For purposes of discussing light in lenses it is customary to consider light as a wave-motion in the ether; but do not forget that there is no ether and that some scientists say that it is not wave-motion—so there we are chasing our tails again. To get started, let us say that a ray of light is a train of impulses projected through space by an excited electron. This train of impulses obeys certain laws—and it is a couple of these laws in which we are interested.

How big is a ray of light?

Light Rays

We get into the habit of thinking of a ray of light as we do of a pencil line on paper, and we know, of course, that a ray of light is commonly expressed in this fashion. But it is not *a* ray but multiple rays—a million, perhaps. An electron is about a hundred-millionths of a millionth-of-an-inch in diameter. If one of these electrons is vibrating at such an amplitude that the resultant wave can be seen as light, hundreds of these waves could ride in a tube the size of a human hair and still leave ample elbow room. So, a line on a piece of paper represents not *one* ray but millions of rays of many frequencies which can be separated into their various frequencies just as a filter can separate radio waves of various frequencies.

Huygens suggested in 1670 that light waves emitted from a point source of light advanced in all direction, and that if a surface is drawn through all the points of vibrations in the same phase, this surface will be a wave-front and the direction this front is advancing is *a ray*



(what's this? . . . a ray of light is a direction *only* and hasn't any size at all. That's even smaller than I said it was). Now, Huygens says further that every point in that wave-front acts as a propagator of wave energy and starts a new wave-front, so that if we deal with wave-fronts and *not with rays*, which are directions only, we can predict just what will happen when light passes through lenses.

Now our drawing (Fig. 1), starts to take on meaning. It never did, in the original, intend to show the course of light rays but an envelope containing some wave-fronts.

Figure 2 illustrates the principle. Take a wave-front at AB. Each point on that front propagates a new front, and if we draw a line through similar points on each of these smaller wave-fronts, we get a new wave-front A′B′. Now, when a wave-front goes through a hole we know from experience that it does not cut-off sharply around the edges but the small wave-fronts lap around the edges, although the main front passes on in its original direction.

Wave Direction

If these wave-fronts are getting larger, they are called *diverging waves.* If they are getting smaller, they are called *converging waves.* If they are progressing in a plane, they are called *plane waves.*

Now, light travels in the air at one velocity, but slows down when traveling through glass. In light coming from the sun the wave-front has a radius of 90,000,000 miles. A small arc of a circle of that diameter would be, as far as we on earth are concerned, a straight line and those waves come to us as plane waves.

Consider in this drawing (Fig. 4), a plane wave-front approaching a bi-convex lens. This wave-front hits the glass in the middle of the lens and that part of the wave slows down; as each part of the front hits the glass it slows down. Then the upper end of the wave-front gets out into the air and speeds up again. That part still in the glass holds back until it is all out, and the front is now converging and comes to a point which is called the *principal focus* of the lens.

With a concave lens, the ends of the wave-front are slowed up first as they hit the glass, the belly speeds up first when it gets through the glass ahead of the ends, and a diverging wave emerges

[1] "Theory of Physics" by Ames.

(Fig. 5). Suppose the one face of this lens were flat: it can be seen in the drawing that a diverging wave still would come out of the lens but it would not be diverging so rapidly.

By the way, where is the focal point of this lens? We described the focal point of the other lens as the point where plane waves were brought to a point, but here these plane waves do not come to a point. This is a negative lens, and the focus is on the opposite side of the lens from which the rays emerge and is called a *virtual focus,* as distinguished from the real focus of the other lens.

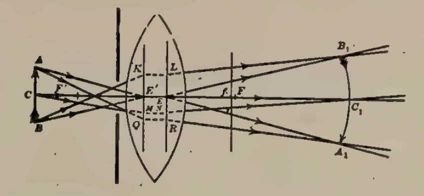
I said that wave-fronts from the sun may be considered as plane waves. For all practical purposes a light wave-front originating, say, 100 feet distant may be considered as a plane wave-front. The waves from your screen to the projection lens are *diverging waves,* and from the lens to the screen are *converging waves;* but for practical purposes they may be considered as plane waves. You probably won't believe this, but we'll prove it sometime.

Taking leave of plane waves for a while, let us consider diverging waves. You will note that the action in Fig. 6 is exactly the same. The belly flattens out, the front straightens out; then the ends get out first and the front begins to converge, but comes to a point much further out. These two points are called the *conjugate focii* of the lens: "jugate" means joined; "con" means together; the "conjugate focii" are the two points joined together or related in this particular lens, and a point light source placed at either place would be focused at the other. (Note that I said *point* source.)

If we move this point source closer to the lens (Fig. 7), the emerging front is curved less and less until when the light is at the real focus of the lens, the emerging wave-front is plane.

Aberration

When we move the point source in further to a point within the principal focus of the lens (Fig. 8), the wave-front does not get a chance to straighten out, the ends never do catch up, and it emerges as a diverging wave. This is all very simple—much too simple, in fact, for in practice nature hands out a lot



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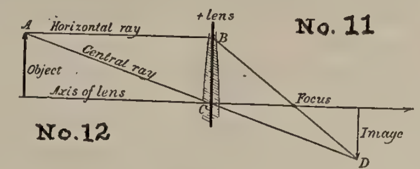

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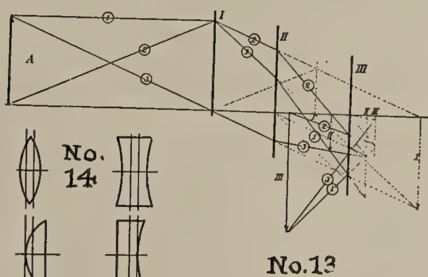

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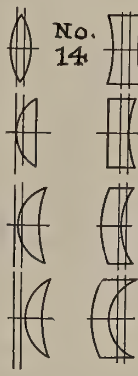

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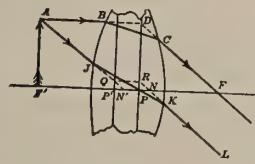

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of jokes and jolts to such things as preconceived notions and the like. We will spend a few minutes considering some of these "jokers."

First we shall consider *spherical aberration* (Fig. 9). The very thing that makes a lens change a wave-front (the varying thickness of glass), also causes the rays at different distances from the center of the lens to focus at different points—with the outer rays focusing closer, and the inner rays focusing farther away from the lens. This condition is corrected by various methods of grinding and by combinations of lenses.

We have an example of partial correction in Cinephor condensers, wherein one surface is parabolic and the other spherical. One point frequently overlooked is that even in the very best photographic lenses spherical aberration cannot be wholly corrected. The outer rays may be made to meet the inner rays, but the intermediate rays will not meet at the same point. The larger the diameter of the lens, of course, the greater the difficulty of correction. Hence, in a camera the smaller the diaphragm, the sharper the picture; in a projector, a diaphragm will sometimes improve an inferior projection lens, although cutting down the light.

Another difficulty is *chromatic aberration* (Fig. 10). We said at the beginning that a pencil of light (represented by a line), was made up of millions of rays of light. If the light be white, it is made up of rays of many different wave-lengths —thousands of them, perhaps. Now, the effect of glass upon the speed of these rays is far different for each individual wave-length, so that if you had a lens corrected for spherical aberration, all the rays still would not come to a point: the blue would focus at, say, *b* and the red at *r*, and all the others in between.

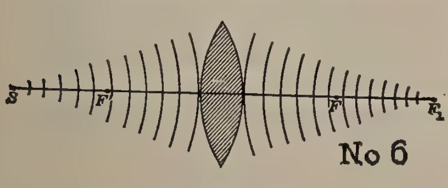
Fortunately, chromatic aberration is comparatively easy to correct. Assuming that this lens is made of crown glass, a lens of flint glass of the same size and shape would spread the blues and reds much further, although the focal point in general would not be much different. A negative lens of crown glass would spread the light in the opposite direction, with the reds closest to the lens and the blues further away. And, a lens of flint glass would also spread them in the opposite direction, only still further apart.

So, to correct for chromatic aberration (Fig. 10A), we take advantage of these properties and combine a crown glass positive lens with a flint glass negative lens, which brings the blues and reds together but makes a combination of a little longer focus. Here again only two colors can be corrected for with two glasses; the others still are out, and it is customary to correct for the two brightest colors. Some high grade photographic lenses have three glasses and correct for three colors.

Calculation

Curvature of field must be corrected for (Fig. 11), to bring the outer edges of the picture in focus on a flat screen when the center is in focus. There are also the problems of astigmatism, coma, distortion and others which we shall not go into at this time.

It is frequently asked from what point



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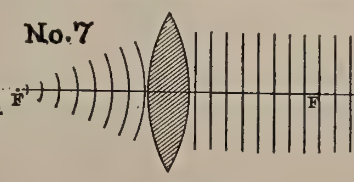

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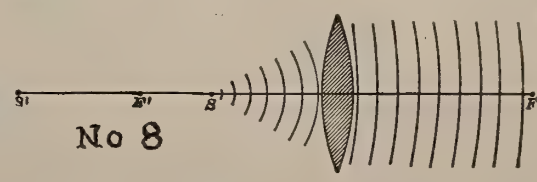

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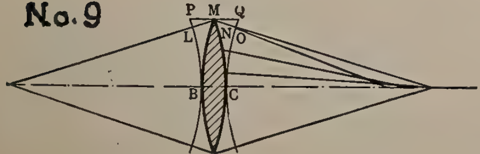

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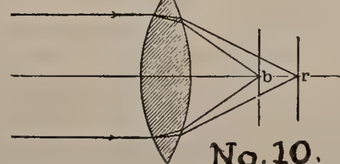

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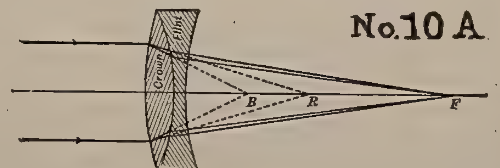


No.10 A

does one measure to get the focal length of a lens—from what part of a condenser lens and from where on the barrel of a projection lens. The answer is generally: from somewhere inside the glass of a condenser and from somewhere between the two combinations in a projection lens.

When dealing with very thin lenses we may consider the lens as a line (like that in Fig. 12), and make our measurements from the center of the lens. While we are considering this drawing, I might describe briefly the point-to-point method of locating an image from an object. Just two simple rules are used, and while the problem can be very complicated, in this case the application is easy:

1. Horizontal rays always refract to the focus

2. Central rays pass through without deviation.

The horizontal rays from the head of the arrow (Fig. 12), are refracted through the focus and the central ray passes straight through the center; where the two meet is located the image of the starting point.

Here is a diagrammatic representation (Fig. 13), of a compound microscope which traces the paths through the objective lens and eye-piece lenses and shows the lenses as represented by straight lines, the particular shape of the glass making no difference. In fact, lenses are designed from such drawings, and when the separation and focal points are determined so as to get the results wanted, then the shape of the glass which will be necessary to give the focal points at the places indicated is determined.

But the lenses we use are not thin. They have considerable thickness, and before any calculations are made the nodal planes must be determined and measurements taken from them. Here (Fig. 14), are represented the approximate nodal planes of the common forms of lenses.

You will note that these nodal planes are as if the line used to represent the lens in the previous drawing (see Fig. 11), were slit in two and pulled apart—which is just what you would suspect that glass thickness might do.

Referring to Figure 15, follow the course of the ray through the lens and note how the drawing made to the nodal planes gives the same result as to the glass surface—so that for purposes of calculation the actual shape of the glass need not be shown.

Getting back to the question of from where are we to measure our lenses, the answer is:—in thick lenses we measure from the nodal planes; and if we keep these sketches in mind, we shall always have an approximate idea of the procedure. The actual point would, of course, have to be determined from each particular lens (see Fig. 14).

We have covered only a few of the simpler principles of lenses, but if these few points are kept in mind, I believe that the topic of the course of light will give you less trouble. I have not been logical. I began nowhere and finished nowhere; but if you are interested, perhaps I can give another talk bearing more directly on projection optics.

'CIMARRON' HEADS TEN BEST POLL

Setting a new record for the number of votes received by an individual picture, "Cimarron" ran away with first place in the list of Ten Best Pictures of 1931, selected by the leading motion picture editors and critics of the country in the tenth annual poll conducted by *The Film Daily*.

Total ballots returned in this vote also set a new high mark of 339. Of this number, "Cimarron" received 273, against the previous record of 271 established last year by "All Quiet on the Western Front."

The other nine pictures to win places were: "Street Scene," 200; "Skippy," 178; "Bad Girl," 172; "Min and Bill," 164; "The Front Page," 162; "Five Star Final," 138; "City Lights," 128; "A Free Soul," 114; "Sin of Madelon Claudet," 99.

It is interesting and perhaps quite significant that practically all of these "ten best" pictures have a strong vein of human interest—heart appeal. This undoubtedly aided them in winning votes above other productions of higher artistic or technical merit but less emotional value. Another point worth noting is that five of the ten were based on stage hits.

WASHINGTON CHOSEN FOR S. M. P. E. MEETING

The Society of Motion Picture Engineers will hold its Spring Meeting in Washington, D. C., May 9-12, according to an announcement made by the Board of Governors of the Society. Washington was selected by the Board of Governors following a majority vote for this city by the membership. W. C. Kunzmann, Chairman of the Convention Committee, and O. M. Glunt, Chairman of the Papers Committee, will prepare the program of arrangements for the meeting which will be held during the height of the Washington Bicentennial activities.

N. D. Golden, assistant chief of the motion picture bureau, Department of Commerce, has been appointed chairman of the local arrangements committee.

OPERATING HINTS

1. Don't use force in driving pins or removing shafts.

2. In removing intermittent movement be careful not to strike the sprocket against the sides of the mechanism.

3. Don't let film trap door slam after threading, as the film may be thrown off the sprocket and ruined when the projector starts. Place finger against trap door and let it close easily.

4. Don't use steel to scrape the emulsion off the film trap and tension springs. Use the edge of a copper coin or other soft metal. Brass is okay.

5. Don't *force* your projector when it seems stiff. It may need oil, or an obstruction may have found its way into the working parts—such as a loosened pin or screw.

6. Don't use alcohol, benzine, kerosene or turpentine as a lubricant. A first-grade medium body oil is recommended.

7. Don't try to put enough oil into mechanism at one oiling to last a week; use less oil and use it oftener.

8. Don't forget any of the oil holes. They are there for a purpose and every one of them is important. Locate each of them on the instruction plates.

9. Don't fail to keep lenses and condensers clean at all times.

10. Don't use a rough cloth or waste to clean optical units. A piece of chamois, linen or soft cloth moistened with ammonia will give the best results, and remove all dirt as well as giving a high polish. Use equal parts of ammonia and water.

11. Don't fail to examine all electrical connections on lamp, rheostat or motor. For any electrical device to be efficient all connections must be firmly tightened.

12. Don't allow water or any dampness to penetrate the rheostat or motor.

13. Don't fail to keep the commutator and brushes on the motor perfectly clean.

14. Don't neglect the arc lamp connections. High amperage eventually chars the asbestos leads nearest the lamp and efficiency requires careful attention to the connections.

15. Don't use oil or grease on lamp joints or rods. Use a little powdered graphite, or a grease graphite, at the joints.

16. Don't expect good results with dirty or pitted carbon jaws.

17. Don't run projector with magazine doors open.

18. Don't allow cold air draughts from a fan or other sources to blow into the lamphouse. Such a draught will invariably result in condenser breakage.

19. Don't screw up condenser rings and holder tightly.

20. Don't fail to wash sprocket teeth at least twice a week with stiff bristled tooth brush dipped in kerosene.

21. Don't fail to match "O" marks when replacing intermittent.

22. Don't fail to keep pad rollers adjusted to two thicknesses of film.

23. Don't bend the intermittent guide apron. To do so will cause serious film damage.

24. Don't forget to oil the take-up spindle.

COMPARATIVE WORTH OF D. C. POWER SOURCES

Samuel Bagno

What consititutes the most efficient source of D. C. power? Is it possible to secure both economy and efficiency in newly developed equipment?

THE problems presented by the need for direct current in projection rooms are quite complex, and this complexity is emphasized by the extreme conditions imposed by the quality of the direct current desired. The photo-cell cannot tolerate a condition such that the direct current have a ripple one one-hundred-thousandth of its amplitude imposed on it. In other words, if the voltage of the photo-cell varied between 99.999 volts and 100 volts at a frequency rapid enough to be heard in the speaker, it would produce an objectionable noise.

The photo-cell is the most important problem, but many others exist. Direct current must be supplied to the amplifiers, the exciter lamp, the speaker fields, and the arcs in the projectors. It is the purpose of this article to compare these various uses and the economy of the many systems employed to supply this direct current.

Because of the various voltages employed, a single source of direct current cannot be employed with desirable efficiency, since, if sufficient voltage were generated to supply the power amplifiers, about 500 volts, 98 per cent of the power would be lost feeding the exciter lamp, and the source would have to be filtered well enough to work the photo-cell and the first amplifier. Such a system would be too expensive, and would generate too much heat to be of definite commercial value. Instead we employ a different unit for every purpose.

Forms Employed

This equipment may take different forms: it may consist of batteries, which supply the pure current; of generators, which have a high frequency ripple and are driven by a single alternating current motor; or of rectifiers. The rectifier, being an instrument to alter the direction of current flow so that instead of reversing itself periodically the current pulsates in one direction only, introduces a type of direct current that cannot be used directly. Like the direct current generator, its output must be filtered before it can be applied. The filtering process is a smoothing-over, that is, the pulsations are removed and a continual uni-directional flow of current results.

A study of the character of the current fed to each instrument will enable us to select that type which is best for each purpose. Since every part of a sound projector is important, we cannot allot preferential consideration to any one unit. Instead we will consider them in the sequence in which they act.

The exciter lamp must be supplied by voltages ranging from 5 to 10 volts, and currents ranging between 3 and 7½ amperes, depending upon the type used. The pulsations of direct current may be one per cent. of the total without an undue ripple resulting in the speakers. Good voltage regulation is essential, since the light generated by a voltage increase varies out of proportion to the voltage change. This light changes the volume of sound generated, and a 10 per cent. change in voltage may produce a 40 per cent. change in volume. An increase in voltage above the rated value of the lamp results in a decreased life. Where the regulation is poor, some instrument must be inserted in the line of the exciter lamp to regulate the voltage within narrow limits.

Storage Batteries

Storage batteries supply a constant voltage without a ripple. Storage batteries, however, are cumbersome and require a separate compartment or room. They are expensive and require continual care. The overall efficiency of a storage battery system is high and compares favorably with the motor generator and rectifier filter system in the matter of current consumed. Storage batteries, however, must be charged, and the charging instruments are the very instruments that may be used to light the exciter lamp directly, namely, rectifiers and motor generators.

Storage batteries act only as direct current filters and voltage regulators. As such they can be replaced by inexpensive filters that require no maintenance. The filtering does not have to be perfect, since the heat inertia of the exciter lamp acts as an additional filter to help smooth the D. C.

The motor generator has the advantage of maintaining a constant voltage as long as the frequency of the alternating current is kept constant. The frequency of the alternating current varies about two per cent. Such a variation is not serious

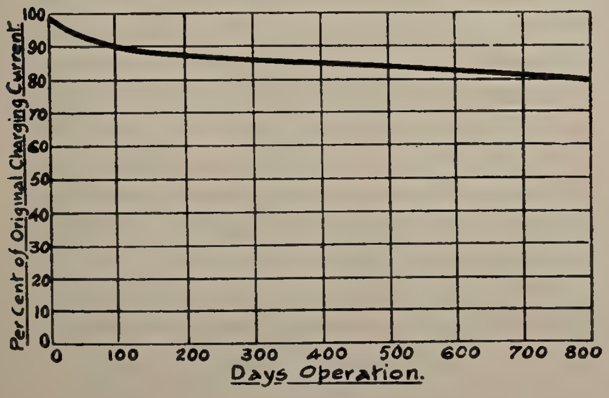


Fig. 1—Life test record of copper oxide rectifier

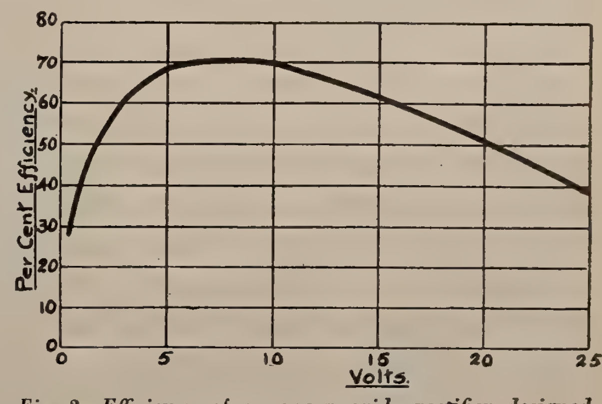
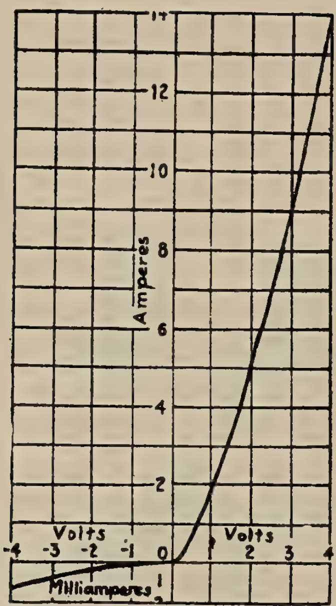
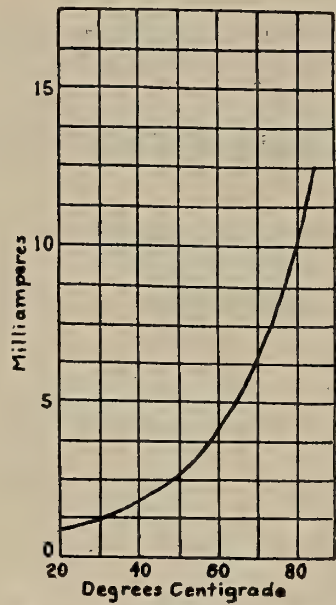


Fig. 2—Efficiency of a copper oxide rectifier designed for 7-volt operation





Left: *Fig.* 3.—*Volt-ampere curve of* 1.5 *inch copper oxide disk. Right*: *Fig.* 4.—*Showing increase of current through the high resistance at constant volts and increasing temperature*

and can be reduced to a negligible figure by an additional winding on the field of the generator. The motor generator has the additional advantages of unlimited life and cheap upkeep.

The ripple caused by the motor generator is very small in comparison to the direct current generated. In spite of this, the filtering employed with such a generator must be effective, as the ripple is of such a frequency as to interfere most with the reproduced sound. The commutator ripple, if permitted to come through the speakers, would give a continuous shrill note of about 1,000 cycles. Also, it may be added, a motor generator system requires constant attention and continual lubrication, is not readily accessible, and costs from two to four times the price of a rectifier filter unit. The ideal piece of equipment can be locked up, forgotten and be dependable enough to give continuous efficient service.

Types of Rectifiers

There are several types of rectifiers that can be used for low voltages, but the cuprous oxide rectifier is the most efficient and least expensive of the lot. Such a rectifier if properly used is indestructible, requires no attention, and is highly efficient. It requires as auxiliary apparatus a transformer to step the voltage down to the required level and a filter system to change the rectified pulsating direct current to pure direct current. It is entirely noiseless and easily replaceable in case of a burn-out. While it is true that the direct current output follows the voltage fluctuations of the A. C. line, the voltage across the lamp can be kept fairly constant by the use of a constant voltage transformer or a ballast resistor. Cuprous oxide rectifiers have proven their dependability in other fields, notably in radio and railroad work, and there is no reason why they cannot work just as well in the projection room.

It may prove of some interest to study the action of a cuprous oxide rectifier. The rectifier is built around the action (first discovered some ten years ago), that cuprous oxide, a copper rust, when formed on a copper plate by heat will show a different resistance to the flow of electricity from the rust to the copper than from the copper to the rust. This action is not chemical nor in any way destructive to the rectifying element, but depends entirely on the crystaline structure of the rust on the copper. These crystals can be altered by excessive heat and the rectifying effect destroyed.

The ratio of resistance current flowing in one direction to the resistance of current flowing in the other direction is about 9,000 to 1. Figure 1 shows a life test average of a large number of rectifiers over a period exceeding two years. The units were kept on test twenty hours a day for eight hundred days—a total of sixteen thousand hours. This approximates four years' use in a projection room. The results show a current drop of about 20 per cent. over this prolonged period. This may sound serious, but in actual practice it is less serious than it sounds. A rheostat may be used to keep the exciter lamp at a constant potential. The efficiency of such a unit after a number of years still compares favorably with a motor generator set, and its output is more constant than the light emitted from an exciter lamp at constant voltage.

The next problem is the photo-cell. Here we want pure D. C.—nothing else will be acceptable. We are confronted again by the three applicants for the task of supplying power: Let us consider each on its merits:

1. The dry cell battery
2. The motor generator filter unit
3. The rectifier filter unit

The dry battery presents an excellent case. Here we have a source of power that is free from any ripple. The life of a set of dry cells when supplying the negligible power required by the photo-cells is equivalent to the shelf-life of the batteries. Such a set if used continuously should last at least one year. This set is inexpensive and easily replaced. The filtering problem is also simplified by the minute amount of energy needed. Several resistors or chokes and condensers can reduce the fluctuation below one part in one hundred thousand.

The source of voltage can be the same source that supplies the amplifiers, and the only additional expense is the filter. The filter need never be replaced, and compares very favorably in cost with batteries. Therefore, although batteries are the ideal source of power, they are not as economical as a filter system supplied by the same source as are the amplifiers.

Amplifier Supply

The amplifiers need direct current to feed the plates of the tubes. They can be divided into two classes: the preliminary amplifier working directly from the photo-cell and supplying the power amplifiers, and the power amplifier that works the speakers. The amplifier problem is analagous to that presented in radio, and the results of many years of radio research and development have supplied us with rectifier tubes to meet our needs. These tubes are rugged and inexpensive and their guaranteed life is from six months to a year. A generator can also do this work, but, as mentioned previously, it requires supervision, lubrication and very much additional space. The output of a generator requires more careful filtering because the ripple frequency presents much more unsatisfactory sound than does the output of a rectifier.

If the commutator sparking is too great, the amplifier may pick up the sound in spite of the best filter available. It is also true that the ear response is several hundred times more sensitive to 1,000 cycles than to 120 cycles. When economy of operation is considered, the motor generator set is more efficient. But the saving is only a few cents a month, which is negligible. When all factors are considered, we find the rectifier unit more desirable as a supply source for the preliminary amplifier as well as for the power unit.

The fields of the dynamic speaker present a problem very much alike that of the exciter lamp. Here we desire direct

current not necessarily entirely free from ripple, since the field of the dynamic speaker in itself acts as a choke. The current drain is from 1 to 3 amperes, and this value depends on the size of the theatre. The voltage regulation is not at all critical, variations of 10 per cent. easily being permissible. This is due to the fact that after the field of the speaker becomes saturated with magnetism, a large variation in magnetizing current produces a small change in magnetic flux. The field coil of the dynamic speaker is used to supply a magnetizing force and thereby create magnetic flux.

Besides the motor generator unit there are two types of rectifiers in general use for this work: the cuprous oxide and the tungar rectifier. The action of the cuprous oxide rectifier has been explained previously. The tungar unit consists of a transformer and two tungar tubes. These tubes have been used as battery chargers for a good many years and have proven very successful for that type of work. However, the continued replacement of tubes that are rather expensive and that are rated for only 3,000 hours renders a tungar unit less desirable than an equally efficient oxide rectifier.

A separate generator may be used for this work, or the voltage may be taken off the generator that supplies the amplifiers. The former is undesirable, because a generator for this purpose is not as economical in initial cost or maintenance as a cuprous oxide unit. The latter procedure is undesirable, because for every 500 watts generated only 100 watts will be consumed in the fields of the speakers.

For each of the purposes outlined above the rectifier is better suited. There is no question that a theatre which can get by with an incandescent lamp in the projector will find a series of rectifier units better than a series of motor-driven generators. The rectifier units are more efficient, less costly, more accessible, and almost as durable. To this can be added the fact that rectifiers require no oiling or attention of any kind.

Arc Requisites

When we consider the arc lamp and its supply, we find a field best suited for the generator set but by no means limited to it. It is true that the majority of theatres employ motor generators to supply the D. C. for their arcs. Rectifiers for this purpose are comparatively new. The mercury are rectifier formerly used has been a misfit for this work. It is much more efficient at higher voltages, only economical above 500 V, and its care and expense make it unable to compete with the motor generator.

In the last few years we witnessed a remarkable development in rectifiers. We now have rectifiers for this purpose which are more efficient than the motor generator set, cost less for service and maintenance, and involve a lower initial investment. The two types now on the market make use of cuprous oxide and tungar tubes. The tungar tubes will probably be replaced with the more durable cuprous oxide. The next few years will witnesses a more serious competition between the rectifier and the motor generator D. C. arc. Without doubt the rectifier will more than hold its own. The future will offer a compact and efficient electrical supply for the projection room in the form of several small rectifier units. The motor generator supply set appears outmoded not because it is inefficient but because it has become uneconomical.

INTERNATIONAL PROJECTIONIST solicited comment on the foregoing article by Mr. Bagno and is pleased to present as an appendage thereto the following comment by well-informed workers in the field:

Addenda:

M. L. Robinson
ROTH BROTHERS & COMPANY

GENERALLY I take exception to Mr. Bagno's use of the phrase "storage battery systems," as one would gather from his employment of this phrase that the battery really acts as a filter. More specifically, I do not believe that the variation of A.C. fluctuation would be more than one-half of 1 per cent.

Good practice demands a commutating frequency of 1,500 cycles for motor generators used with sound systems, and a Roth generator set for such service would have at least that frequency for service. Any well-designed unit would be similar. Besides, this is a very easy matter to filter in comparison with the lower frequency fluctuations of a rectifier.

Rectifiers burn out and the transformers and resistors employed reduce efficiency and do not actually regulate for line fluctuations. In addition to line fluctuations, provision must be made for a constant drop in voltage.

It may possibly be true that the ear response is so very much more sensitive to 1,000 cycles than to 120 cycles, but in any event the filter in the latter case would be far more expensive. We would expect our generators for sound systems to have a commutator frequency too high to be objectionable. I believe Mr. Bagno's statements with reference to the ill effects of a commutator ripple are all wrong. It is significant, however, that he does admit a "slight saving" in favor of motor generators.

Proof Lacking

In regard to his statement concerning the copper oxide rectifier, what basis of proof has Mr. Bagno for stating that "they are more efficient, less costly, more accessible, almost as durable, and require no attention"? As Mr. Bagno has never tested Roth motor generators for sound systems (and we have our doubts that he has tested other makes on the market), it appears to us that he is taking the word of the companies making rectifiers for the statements he makes. Unless his rather general statements can be shown to be accurate, they should not be printed.

The mercury arc rectifier is economical only above 500 volts and cannot begin to compare with a motor generator for the reason that it requires a great deal more care and is also very expensive.

Earlier in his article Mr. Bagno admits a slight saving in favor of motor generators, but near the end in granting the advantage of a rectifier economy as compared with motor generators, he seems to be dealing with a rectifier as yet undeveloped. His whole last paragraph, it seems to me, is pure assumption in offering as a statement of fact that which has not yet come to pass.

In making the statement that the motor generator is doomed because its use is now uneconomical, he submits no proof to back up his contention. We regard this as a very unfair statement, as it is obvious that such a statement should not be made unless Mr. Bagno really has engineering data based on the performance of the leading motor generators now being used in the industry.

His article may prove of some value in the way of general information, but one who knows something of the practical application of these various units will undoubtedly have a number of questions to raise. His statements about other than cuprox rectifiers are distorted, we believe, and may have the opposite effect to that desired.

Anonymous

[NOTE: *The following opinion is the contribution of a director of projection for a large theatre circuit*—EDITOR.]

AS early as the second paragraph of Mr. Bagno's article I find myself in disagreement with him. He positively asserts that *direct current* must be supplied to the photo electric cell, amplifier, exciter lamp, speaker fields, and arcs, and then he immediately states that his

(*Continued on page* 31)

WANTED: A NATIONAL SOCIETY OF PROJECTIONISTS

James J. Finn

SOMETIME ago we pointed out the urgent necessity for a national projectionist society—an organization which, while having its roots in the various International Alliance local unions, would give that certain stabilizing social and educational force so lacking in unions today; that certain something which, however reluctant we may be to admit it, the labor union does not and probably never will give. The shortcomings of the union in this respect may occasion considerable surprise among a majority of people who instinctively associate fraternalism with a labor union. The reason why this should be so is not hard to find.

Labor unions have made a fetish of establishing wages and working conditions—so much so that the fraternal aspects of a union have been permitted to be slowly pushed into the background, obscured and, save for the time-honored "fraternally yours" appended to correspondence and the like, obliterated. Members have taken their cues from the unions' officers in the matter of regarding the union merely as a business clearing house. Particularly is this true of the larger city unions. A majority of union leaders will reply to this argument that they are running a labor union and not a girls' school. This is a fallacious argument and quite silly in these days of enlightened thought.

Developing Craft Morale

A labor union must contribute more to and be thought by its members to stand for something more than merely a clearing house for the union's business.

Labor unions might well take a leaf from the books of the large corporations in America today in seeing to it that their members' social and educational needs are adequately cared for.

Unions can never expect to receive from their members that loyalty so necessary to the successful conduct of the labor union unless they in turn give something to the members which will inspire that loyalty.

That loyalty will never be forthcoming so long as the members regard their unions merely as business clearing houses. With unions tending only to the purely physical needs of their members it is but natural that the members should think of the union in economic terms only.

Apart from the work of socialization, the formation of a national projectionist society would net the union other and vastly important returns. There is the matter of education and also the matter of adequate representation in the councils of the industry in which the union operates. We shall first consider education.

The number of local unions of the I. A. now engaged in educational activities for their members is so small as to be insignificant—and this in defiance of definite charter and constitutional requirements. If labor unions would stop and reflect upon their modus operandi, they would quickly come to the conclusion that that which they are selling is not organization, union labor as such, or any much-discussed but actually non-existent commodity, but merely a guarantee of better work.

The day when a man can think of his job in terms of the measure of protection afforded him by his union card is gone—definitely. We have often said that a union, particularly an I. A. union, must display as much interest in and enthusiasm for the educational features of the organization as it does in the matter of wages and conditions.

All this is so very elementary that there would seem to be no need to set it down here; yet there are many who would resist any attempt to popularize such a program.

Projectionist unions have but one thing to sell, and that one thing is superior work. And superior work can be had only from competent craftsmen.

Competence can be attained only through study and training, and it is this which is primarily the function of the union. An educational program will pay rich dividends. Only a national society can provide such a service.

Adequate Representation

What is this thing so loosely phrased as "adequate representation in the industry" which we mentioned previously?

Just this: projectionists are just as much a part of the motion picture industry as are actors, directors, cinematographers, studio workers, manufacturers, distributors, exhibitors, and executives. Their contributions, while probably not as large as some other groups in a strictly monetary sense, are none the less tangible. Projectionists have a large stake in the industry, and they should be represented in those councils which have a bearing on their work.

The introduction of the Standard Release Print and, lately, the new standard aperture provide concrete examples of the need for an alert projectionist organization. Projectionists should be consulted on such matters for the simple reason that they are in a position best to know the technical requirements as well as being the group which has to put into operation any such plan.

Had it not been for the American Projection Society and the Projection Advisory Council, projectionists would have heard about the S. R. P. only when they handled the first S. R. P. print. Imagine!

It reflects no discredit upon the managers of societies like the American Projection Society and the Projection Advisory Council to state that both organizations have failed miserably to accomplish that which they had hoped to do. The reason for their failure is all too apparent: lack of support on the part of projectionists. Projectionists as a craft are notoriously indifferent to any attempt to render them a service. They will take all they can get in the way of such service—that is, provided it is brought

to their bedsides on a tray. Cooperation is assumed to be the keynote of the labor union, but we are beginning to suspect that projectionists don't know the definition of the word.

We repeat: the A. P. S. and the P. A. C. had good merchandise to sell, and the men who were selling this merchandise were earnest, self-sacrificing, and hard workers. The support accorded these men was at best meagre; in fact, their efforts were often subject to sniping from the indolent sideliners. Who will say no?

Other Organization Affiliation

We hear a lot of talk about the Society of Motion Picture Engineers and the Academy of Motion Picture Arts & Sciences. Who will say that either or both of these organizations can serve the projectionist in the manner previously outlined? The bare statement that we hear a lot about these organizations is in itself a tribute to the value of organization in that their publicity bureaus are functioning. But no publicity bureau is functioning for the projectionist for the reason that he himself makes it impossible.

Let's face the facts: Neither the Academy nor the S. M. P. E. can give the projectionist one one-hundredth of that which he would receive from his own organization. Projectionists owe allegiance first to their own organizations.

Yet we have seen the very same projectionists who disdain the opportunity for rendering their own craft a service labor long hours on an S. M. P. E. committee and stretch themselves out in an effort to please. To please whom? It's a funny thing, this glamour of a name. Talk projection or projectionist to these men and they are not interested; talk S. M. P. E. or Academy and their hearing suddenly becomes very acute. Projectionists themselves are in large part responsible for this condition.

Imagine the spectacle of an organization, one local unit of which can raise a quarter of a million dollars overnight, not spending one cent for educational purposes. We never heard of such a thing. For shame!

Now Is the Time for Action

The time has come for projectionists to consider seriously this whole matter of a national society. Just thinking about it will do no good at all. Societies cost money to operate, and unless projectionists come across with the hard cash there is not a chance in the world of ever putting the plan across.

How much would it cost? We should say that for not more than one dollar a year for each man in a direct tax to national headquarters (irrespective of local unit costs), projectionists would have just about the finest society in existence—a society that would amaze everyone by the quality of service rendered and would pay fabulous dividends in increased prestige for the craft.

Who will welch for one dollar? Probably no one; but there must be something more involved than the mere giving of one dollar.

There must be recognition of the fact that projectionists are a very important part of this motion picture business and also an earnest desire on the part of the members to see their craft gain increased prestige and importance. Freely translated, this added prestige means a more secure livelihood and higher monetary returns.

The task is too difficult, do we hear? Nonsense. Any craft that can boast of such men as Harry Rubin, R. H. McCullough, Chauncey Greene, Lester Isaac, Victor Welman, Frank Seavier, W. G. Woods, M. D. O'Brien, Thad Barrows, George Edwards, F. H. Richardson, Jesse Hopkins, C. A. Dentlebeck, Sidney Burton, C. Curle, William S. Roberts, Lawrence Katz, and a host of others who have worked for the interests of the craft in the past—we repeat, any craft that can boast of such men need have no fear of a difficult task.

Be somebody in your own business—even if you are forced into it!

DAMAGED FILM: DEFICIENT EQUIPMENT AND THE RESPONSIBILITY THEREFOR

JUST one of those things that are happening every day in this industry of ours and to which no importance would be attached by nine out of ten editors was the recent arbitration case of Columbia Pictures Corporation against the Jersey City Theatre. The matter at issue was an old story—film mutilation; but the method of procedure in trying the case and the decision rendered are of far-reaching importance.

Briefly stated, the case was one in which Columbia asked to be recompensed in dollars and cents for damage done to one of its prints—ostensibly in the Jersey City Theatre. Columbia contended that the print was in perfect condition when delivered to the theatre; the theatre submitted a defense which consisted of the bare statement that the print was not in good condition when received. We assume that Columbia introduced in evidence its exchange records on the print in question and that the Arbitration Board accepted these records at face value. This procedure is of small interest to us.

That which does interest us very much, however, is the fact that the Board decided in favor of the plaintiff (Columbia), and the theatre was asked to pay for the print—in dollars and cents. It is conceded that the testimony of the projectionist who was called as a witness was the hinge upon which the case turned—this and the fact that the theatre was privileged to return a defective print and ask for another.

This stuff of a theatre returning a defective print and requesting another is all nonsense. If they had returned it, the exchange might have told them they "were crazy" or given some other such enlightening answer; and the chances are that the theatre didn't have sufficient time to do this before the show opened. Such is our distribution system in this business that a can of film is often hurled

against the door not more than fifteen minutes before show time. In cold weather, such a delivery system provides a juicy morsel for a high intensity lamp.

A "Very Reluctant Witness"

We are informed by Louis Nizer, attorney for the New York Film Board of Trade, that the projectionist proved a "very reluctant witness" (for obvious reasons, we say), but that he finally admitted that dirt or dust gathered in the aperture *could and often does* scratch the film, as would defective equipment in the nature of worn sprockets, uneven tension, and other things. The aperture business, however, seems to have carried the day for the plaintiff.

It seems to us that this is a slipshod manner in which to decide such a case. Mr. Nizer is known to us to be an excellent attorney and he undoubtedly is to be congratulated on the score of recalling that a clogged aperture *can and does* scratch film. But so many things enter into a case of this sort, including the nature of the film stock itself and the manner in which it was handled, that it seems wholly unfair to decide a case upon such sketchy evidence. Expert testimony by one who knew something about film, equipment and mutilation might have changed the whole complexion of this case.

The important points brought into relief by this case are (1) the theatre's responsibility to provide equipment in good working order; (2) the distributor's responsibility to provide the exhibitor with an opportunity for close inspection of a print; (3) the projectionist's responsibility to the theatre in keeping the equipment in good working order; and (4) the union's responsibility in seeing to it that there is a man on the job who *is* competent in protecting the exhibitor's interest. (It will be seen that we have finally worked around to the thesis of the preceding article in this section.)

The lessons to be learned from this case are plain—very plain.

Mr. Exhibitor has learned that of two means of effecting economy that of paying—in dollars and cents—for damaged film is not the easiest way out. With the same defective equipment the incident might recur again and again, and the bills for damaged film come in again and again.

Mr. Distributor must be taught that he has some responsibilities in this matter, in the way of considering the quality of film stock, inspection and handling in the exchange, and, finally, a delivery system which will give Mr. Exhibitor a chance to see what he is getting. Not to mention the h.i. lamp angle.

The Projectionist Angle

Mr. Projectionist might learn the value of insisting that worn parts be replaced and also that careful, periodic attention to fundamental maintenance details is highly important.

The Local Union should learn that it is its responsibility to supply a projectionist who is competent in all these details.

Suppose Mr. Exhibitor should tire of paying these film mutilation bills and should attempt to pass them along to the projectionist and to the Local Union? What a howl would rise to the heavens! But, say we, why all this excitement? Just pass along the matter to that non-existent national projectionist society which we were discussing only very few minutes ago. The SOCIETY will battle valiantly for the projectionist—that is, when it is organized with all the dollars it receives from projectionists. We hope no one is injured in the crush to pay his money.

We invite the attention of Mr. Nizer of the New York Film Board of Trade to this little story; also, we ask Mr. A. S. Dickinson of the Hays office to consider the matter a bit. Projectionists and local unions get the idea right away, we are sure, thus we shan't have to make a special plea for their attention.

This one case provides more "meat" relative to the matter of film mutilation than all the learned discussions we have ever listened to or read about. This is not "committee business"; this is the *real* thing.

ALL AMPLIFYING EQUIPMENT REQUIRES CARD MAN

On several ocacsions it has been called to the attention of the I.A. General Office that traveling companies have been moving about the country carrying amplifiers, etc., and getting by the local unions without having placed a member of the Alliance. Naturally, when they arrive at the next stand and are informed of I.A. requirements, they relate the position maintained at the preceding point and strenuously protest, feeling that they are being imposed upon.

Indifference, neglect or unfamiliarity with the International By-Laws may be responsible for this condition, which was brought to the attention of the Delegates at the Thirtieth Convention in Los Angeles, in the form of Resolution No. 13, which was unanimously adopted.

As this type of attraction appears to be increasing in number, special attention is invited to the following resolution adopted at the Los Angeles Convention:

To the Officers and Delegates of the 30th Biennial Convention of the I. A. T. S. E. & M. P. M. O. of the United States and Canada:

BE IT RESOLVED ,That Article 5, Section 4, Page 55 of the By-Laws, which reads as follows:

"Any vaudeville act carrying stereopticons, spot, flood or effect lamps (such as waterfall, fire, cloud, lightning effects, etc.) or sufficient other electrical apparatus, shall be required to employ a member of this Alliance to care for and operate such equipment," be changed to read as follows:

No Exceptions

"Any vaudeville act carrying public address machines, practical radio sets, amplifying equipment, television apparatus, stereopticons, spot, flood or effect lamps (such as waterfall, fire, cloud, lightning effects, etc.) or sufficient other electrical apparatus, shall be required to employ a member of the Alliance to care for and operate such equipment."

The provisions of the amended section are very definite and leave no question as to its intent of just what type equipment is implied, as it distinctly states *amplifying equipment.*

CELEBRATE INJUNCTION VICTORY

Local 203, of Easton, Pa., held a "Victory Banquet" in Easton, on January 16th, to celebrate its victory in an injunction fight with a local theatre. The Easton fight was of much interest to organized labor in that it marked the first case to be tried under the new Pennsylvania injunction ruling, which gives the defendants the right to a hearing before a temporary injunction is granted.

Among those present at the banquet were: William T. Richey, Pennsylvania representative of the A. F. of L.; Fred J. Dempsey, I. A. General Secretary-Treasurer; Louis Krause, I. A. Assistant President; I. A. Trustee, William Scanlon, Lynn, Mass.; Vice-President William J. Harrer, Philadelphia; Lawrence J. Katz, Secretary Fourth District; John Shanahan, B. A. Philadelphia stagehands local; Lew Glendenning, Atlantic City local union, and James J. Finn.

LAMP EQUIPMENT: OPERATION AND MAINTENANCE

R. H. McCullough

DIRECTOR OF PROJECTION AND ELECTRICAL EQUIPMENT, FOX WEST COAST THEATRES

MOTION picture projection is a highly specialized art which has gone steadily and speedily forward; as it develops it is becoming more exacting in its demands. Good projection is based on sufficient screen illumination, good definition, and steadiness of the projected image. There is no excuse for discoloration on the projection screen, which is ordinarily caused by negligence in handling the projector arc properly. The successful projectionist studies projection problems carefully, he is never over-confident, and during the picture presentation he gives the projected picture constant attention.

I have seen many projected pictures with shadows, which appeared to be a projection fault. The experienced projectionist is very capable of determining projection faults at a glance. The most serious general problem of today is that many theatres are not adequately equipped so as to provide sufficient screen illumination. However, I find many theatres with the best of equipment and yet the screen results are very poor. Projection screens are not given enough attention. We all know that projection screen surfaces should be inspected from time to time. Dirty projection screens should be cleaned immediately and, if necessary, the surface should be re-finished so as to insure good projection.

Carbons

Old-timers will remember the trouble which was encountered occasionally with the old-style projector arcs travelling or wandering, especially when using high amperage on D. C. In those days it was common practice to use a regular cored or solid negative carbon which was slightly smaller than the positive carbon. The operation of this arc required great skill. The introduction of the Silvertip negative carbon in those days was a great relief to many projectionists. With the use of the smaller diameter carbon, covered with a metal application, a much steadier arc could be maintained. The reason for applying metal over the entire outside surface was because a carbon of small diameter, such as the Orotip, without a metal application would not carry the current.

It has been my experience that by carefully analyzing each complaint most troubles with carbons can be traced to the operating conditions. Projector arc lamp housings should be cleaned before the start of the daily performance. All parts of the projector lamp should be kept thoroughly clean at all times and the projectionist should carry out the instructions given by the manufacturer as to the lubrication of certain working parts. Carbon jaws and carbon brushes should be inspected and cleaned at regular intervals, so as to prevent corrosion.

All electrical connections should be kept perfectly tight. The projectionist should be positively sure that he is using carbons of the proper size, so as to obtain the most illumination possible with the amount of current that is being used. When carbons are overloaded, they will spindle and needle. When the positive carbon needles, due to excessive overload, the crater area will be reduced. If more illumination is required and the projectionist raises the amperage above the rating of the carbon, thus causing the carbon to needle, it is very clear that the electrical energy will be wasted. Spindling and needling of carbons may also be caused by poor carbon jaw or brush contacts. The ammeter (connected to the arc circuit), reading should be vertified occasionally so as to ascertain if the reading is correct.

L. I. Reflector Lamps

This type of projection lamp, with the positive and negative carbons set in a horizontal position, has given very little trouble. The ordinary 12 mm. x 8″ positive carbon, and the 8 mm. x 8″ negative carbons for horizontal trims, are rated for a maximum of 25 amperes. If the amperage for these carbon sizes of ordinary manufacture are increased to 30 amperes, the arc will be very unsteady at times and will require considerable attention—also, the carbons will spindle and needle.

The low intensity horizontal reflector arc is very sensitive to draughts of air due to the fact that the current employed is considerably less than that used in any of the other types, resulting in the emission of a comparatively weak arc stream. The exhaust vent for this type of a lamphouse should be so regulated by the use of a damper in the duct directly above the lamphouse that the arc will not be extinguished. Carbons are obtainable for the low intensity reflector arc lamp whereby this lamp may be operated with 30 or 40 amperes with satisfactory results.

I have found that mirrors supplied by reliable manufacturers will stand the increase in temperature rise if it is found necessary to increase the amperage to 40 amperes with the low intensity reflector lamp. It is needless to say that the mirror reflector requires constant attention in regards to cleanliness. This mirror may be cleaned by breathing on the surface, while it is cold, and then wiping and polishing with a very soft clean cloth while still damp. This method will be found to be satisfactory. A solution of equal parts of wood alcohol and water will be found to be effective for cleaning mirrors. A dirty mirror will naturally reduce illumination, therefore, they should be inspected quite frequently.

Many theatres on the West Coast have converted the low intensity reflector lamp

OVERLOADING OF CARBONS

AN operating fault which is common, not only to high intensity lamps, but to all lamps, as well, is the overloading of carbons. Carbons, like other manufactured articles, have physical limitations. If a carbon designed for 100 amperes is burned at 130 amperes, the natural result is short life and spindling.

If carbons are spindling, the first move should be to check the amount of current drawn at the arc. It frequently happens that the ammeters have not been calibrated since they were installed, and as a result are not reading correctly. This is no reflection whatever on the make or type of ammeter in use as ammeters are very sensitive and consequently require attention from time to time. Ammeters off as much as 20 amperes, have been found.

If your ammeter has not been checked for some time, it is suggested that you have the power company supplying your current check the current at the arc for you.

from a 25-ampere lamp to a 75-ampere lamp. A special preparation is used on the back of the mirror so that the mirror will withstand a high degree of heat. The negative carbon holder is changed to accommodate the increased amperage when converting this lamp. Two clamped type carbon contact brushes are installed within 2 inches of the arc, which supplies current to the positive carbon.

The carbons used after converting this lamp are 11 mm. x 20″ hi-intensity for the positive carbon, and 11/32 x 9″ Orotip for the negative carbon. The lamp works identically the same as the low intensity reflector arc with the exception of the increased amperage. The positive contact brushes are located so that a length of 2 inches of the positive carbon carries the current load between the contact brushes and the positive crater. A shutter is installed between the arc and the mirror so as to protect the mirror while the arc is being struck.

With the use of the hi-intensity carbons, the light received from this lamp is a bluish-white similar to the light obtained from other hi-intensity lamps. I do not recommend the conversion of the low intensity reflector lamp to a makeshift hi-intensity reflector lamp.

H. I. Reflector Lamp

This type of projector lamp has given very good results. An air-cooled hi-intensity reflector lamp operating at 85 amperes will provide 14 foot-candles of illumination over a screen area of 600 square feet—which is satisfactory illumination for a sound projection screen in a theatre with a seating capacity of 2,500 seats. This lamp when operated at 85 amperes produces approximately 1,200 degrees of heat at the projector aperture. Rear shutter attachments which will reduce the heat at the aperture by 50 per cent. are absolutely essential when using these lamps, otherwise the heat at the aperture will cause the film to buckle and will also cause the component parts surrounding the aperture to become warped.

The hi-intensity reflector lamp requires considerable attention. I have found if the manufacturer's operating maintenance instruction are followed carefully, this type of a projection lamp will last indefinitely. The carbon consumption and wastage is excessive, when using the hi-intensity reflector lamp. However, since carbon economizers have been perfected for this lamp, carbon wastage has been reduced by about 15 per cent. The mirror reflectors for these lamps also require constant attention with regard to cleanliness.

This lamp is very efficient and produces very good results. The amperages range from 110 to 160 amperes with this type of lamp at the present time. Recent developments in the optical system of the hi-intensity lamp has again made this lamp the most popular lamp for projection purposes. By installing a larger collecting lens of 6⅜″ in diameter and a front condenser lens of more converging efficiency of 7 3/7″ in diameter, using 120 amperes, the results obtained are far superior to those obtained by using 160 amperes with a 4½″ x 6½″ rear condenser lens and a 5″ x 9″ front condenser lens.

Condenser Breakage

It is imperative to use the hi-intensity lamp where the Magnascope and other large screen sizes are being used so as to obtain the correct amount of screen illumination. Many theatres are using the sphero-cylindrical 5½″ diameter collecting lens with the front converging sphero-aspheric 6″ in diameter condenser lens. This is a condenser combination which is manufactured by one of the leading lens manufacturing companies. I used this condenser combination during the presentation of the Fox Grandeur productions *Happy Days* and *The Big Trail*. This condenser combination produces a rectangular or oval spot at the aperture, which is necessary when projecting 70

DUOVAC TUBE CHARACTERISTICS

Table showing essential characteristics of Duovac tubes used in sound reproducing equipments

Type	Use	Filament Supply	Filament Current Amperes	Plate Supply Volts		Grid Bias	
				Detector	Amplifier	D.C. on Fil.	A.C. on Fil.
DX-112-A	Detector Power Amplifier	5.0 V. A. C. or D. C.	0.25	45	90 135 180	4.5 9.0 13.5	 11.5 15.0
DX-171-A	Power Amplifier	5.0 V. A. C. or D. C.	0.25	..	135 180	27.0 40.5	29.5 43.0
DX-210	Power Amplifier	7.5 V. A. C. or D. C.	1.25	..	250 350 425	18.0 27.0 35.0	22.0 31.0 39.0
DY-224*	Radio Frequency Amplifier	2.5 V. A. C. or D. C.	1.75	..	180 180	1.5 3.0	1.5 3.0
DY-227	Detector Amplifier	2.5 V. A. C. or D. C.	1.75	45	90 135 180	6 9 13.5	6 9 13.5
DX-250	Power Amplifier	7.5 V. A. C. or D. C.	1.25	..	350 400 450	59.0 66.0 80.0	63.0 70.0 84.0
DX-281	Half-Wave Rectifier	7.5 V. A. C.	1.25	A. C. Plate Voltage (Max. R. M. S.).......700 D. C. Output Current (Max. M. A.)..........85			
D-264-A	Audio Amplifier	1.5 V. D. C.	.300	..	90	4.5	....
D-205-D	Audio Amplifier	5.0 V. A. C. or D. C.	1.65	..	350	20.	22.5
D-242	Audio Amplifier	10. V. A. C. or D. C.	3.25	..	1,000	50.	55.
DX-280	Full-Wave Rectifier	5.0 V. A. C.	2.0	A. C. Voltage per Plate (R. M. S.)............350 D. C. Output Current (Max. M. A.).........125 A. C. Voltage Per Plate (Max. R. M. S.).......400 D. C. Output Current (Max. M. A.)..........110			

*Has screen grid voltage of 75 and 90

[*This table prepared exclusively for* International Projectionist]

mm. film. I find, however, that this condenser combination is unnecessary when projecting 35 mm. film.

I have encountered very little trouble with condenser breakage with the use of hi-intensity lamps. If the projectionist is careful when striking the hi-intensity arc, and makes sure that the inside dowser is closed, this will protect the condenser lens considerably. The lamp housing should be well ventilated, which will also prevent condenser breakage to a certain extent. The rear condenser over a period of time becomes badly pitted from the metal particles from the projector arc carbons. I have been using heat-resisting condensers in all hi-intensity lamps. These condensers may be re-surfaced by any good reliable glass company, thus removing all pits from the surface, at a price of 7c each. It is also possible to use a piece of Ignal Heat Resisting Glass, so as to protect the rear condenser lens. When this glass becomes badly pitted it may be replaced with a new piece of glass. Carbon consumption and also carbon wastage is very excessive when using the hi-intensity lamp. Carbon economizers are now being manufactured for the 13.6 mm. carbon and also for the 16 mm. carbon which will effect a considerable saving.

The care of the hi-intensity lamp positive contact shoes is very important. A very fine grade of emery cloth should be used to clean and polish the contact surface of these brushes. As these brushes are formed to the size of the carbons used, it is important to retain this form. I have found that the best and the easier method for cleaning and polishing the positive contact shoes is as follows:

Use a spindle of the same diameter as the carbon, bored so as to fit an ordinary film rewind. This spindle should be slotted so as to accept the insertion of a piece of fine emery cloth. The contact brush to be cleaned is held by hand against the emery cloth, which is fastened to the spindle. By operating the rewind the brush is cleaned and polished as desired. I have found that if this method is used for cleaning the contacts of hi-intensity lamp brushes, less emery cloth will be required. Hi-intensity lamps, like all other manufactured equipment, have physical limitations. Cleanliness and good care will govern the life of this equipment.

EMERGENCY M.G. HOOK-UP

M. D. O'Brien

Assistant Director of Projection, Loew Theatres

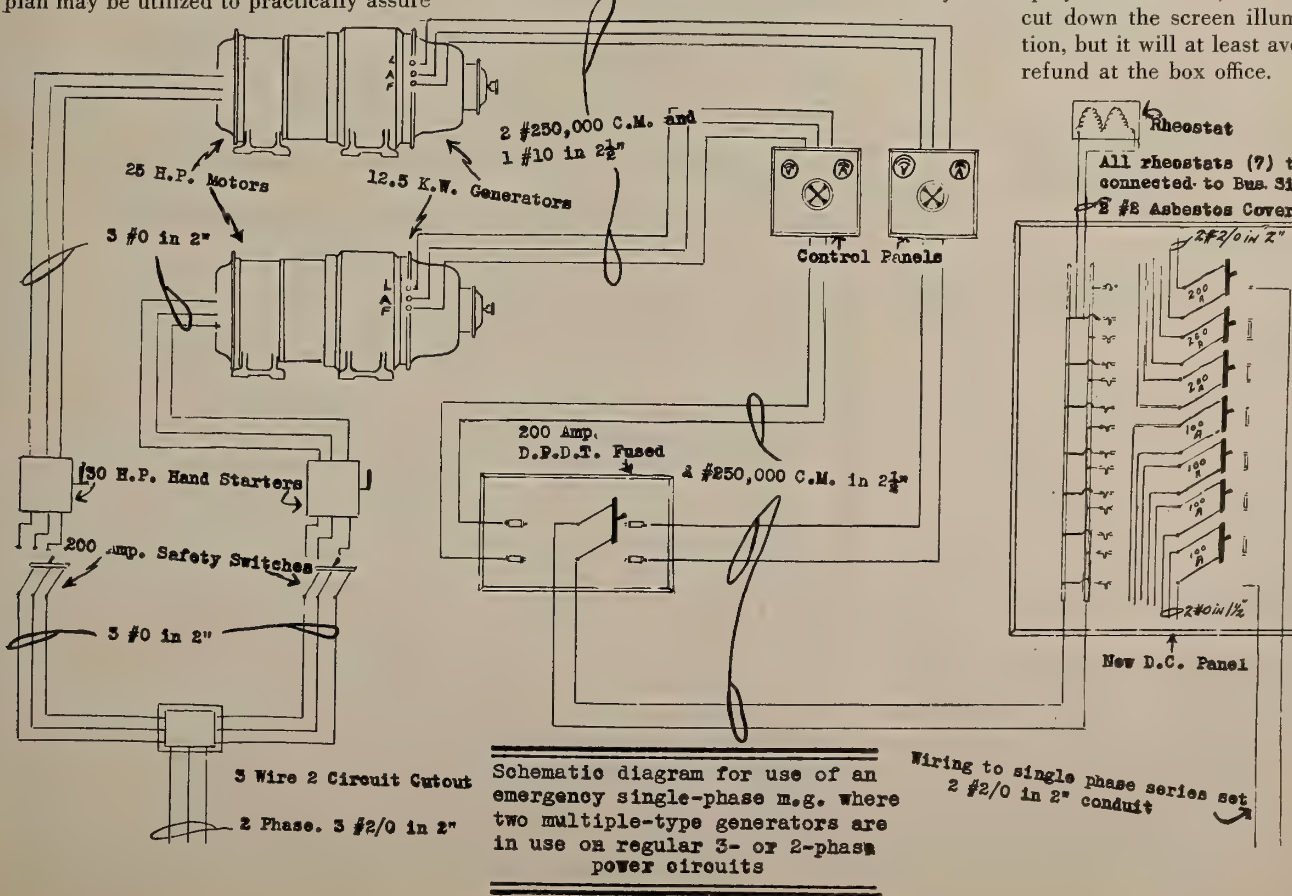
IN some states the unreliability of the three-phase alternating current is so pronounced that certain theatres have found themselves without current for operating their motion picture projection generators, in some instances for periods of as much as an hour.

This condition has been partially overcome by the installation of tremendously expensive storage battery equipment; but in the case of the smaller theatre, which cannot afford this expenditure, a simple plan may be utilized to practically assure the theatre of constant operation under any emergency.

If the present motion picture projection generator equipment is operating on three-phase, and if single-phase current is available, an emergency motor generator set can be installed to operate off the single-phase lighting circuit and thus keep the show going until such time as the three-phase current has again been provided.

The accompanying blue-print shows an actual condition where two multiple-type motor generators were installed on the three-phase [or, in this particular instance, two-phase], power circuits, and a smaller series type single-phase motor generator was installed on the lighting circuit. This single-phase motor generator has paid for itself many times over in guaranteeing continuous projection and an uninterrupted picture on the screen during a period of failure of the two-phase circuit.

In the event that the theatre is not wired with sufficiently large lighting feeders, a smaller motor generator than that which is used for the regular picture may be employed. This will, of course, cut down the screen illumination, but it will at least avert a refund at the box office.



Schematic diagram for use of an emergency single-phase m.g. where two multiple-type generators are in use on regular 3- or 2-phase power circuits

NEWS and VIEWS

A collection of random thoughts, and some not so random; fact, fancy and opinion pertaining to the projectionist and projection matters. The free-for-all forum.

Lower Insurance Rates

EXHAUSTIVE investigation of present working conditions in projection rooms has resulted in a lowering of rates on life insurance for projectionists by the Central Life Insurance Company of Cincinnati. The findings of this company probably will be reflected in similar reductions by practically all insurance companies. The savings affected are shown in the comparison of old and new rates which follows:

Old Rates

Class A—Licensed Projectionists: Extra rating $2.50 per thousand. Standard double indemnity and waiver of premium clauses. No term insurance allowed.

Class B—Unlicensed Projectionists: Extra rating $5 per thousand. Standard double indemnity. Double premium for waiver of premium clause and no term insurance.

New Rates

Class A—All licensed projectionists who use modern equipment and who are employed by the major circuits, namely, RKO, Fox Publix, Loew, and Warners, will in future be charged *standard rate* of premium. Also standard rate for double indemnity and waiver of premium clause. There will be an exception, however, on term insurance.

Class B—Unlicensed Projectionists. Extra rating $2.50 per thousand. Standard rate for double indemnity. Standard rate for waiver of premium but no term insurance.

The investigators were convinced that projectionists working in present-day theatres should not be subjected to an increased rate, the general opinion being that no special hazard is incurred in such theatres.

While the deciding factor is the conditions under which the men work, it is apparent that the terms "licensed" and "unlicensed" are very ambiguous as here applied, as is the phrasing "modern equipment." Just what constitutes "modern equipment"? Also, there are a great many circuit theatres that couldn't begin to compare in the matter of modern equipment and advantageous working conditions with any number of smaller and unaffiliated theatres. Under the new plan the later group undoubtedly is being discriminated against.

The task facing the insurance company with regard to setting a fair rate is not an enviable one, for, in order to be wholly fair they would have to investigate the working conditions of every applicant. However, it does seem as though a better interpretation of what constitutes modern equipment could be drawn and that some provision be made for the up-to-date unaffiliated theatre.

Projectionists are indebted to Mr. A. S. Dickinson of the Hays office and to Mr. J. E. Firnkoess of the RKO Palace Theatre, Cleveland, for their cooperation in this matter.

A Bow to Kansas City

GEORGE A. YAGER of Salt Lake City Local Union 250 writes in to say that credit given his local for a model newspaper advertisement in our November, 1931, issue should be apportioned as follows: The heading was taken from an ad. which appeared in the *Kansas City Star* in connection with a safety campaign inaugurated by Walter S. Croft of Local Union 170. The body of the ad. was taken from an idea gained from material of the Lancaster, Pa., Local Union, as was also the slogan "Silently, Safely, We Serve You" . . . . Well, better late than never.

Mr. Crabtree on Halation

OUR curiosity aroused by seeing in an issue of that splendid publication *International Photographer* a picture of a cactus tree the arms of which were surrounded by a halo that looked suspiciously like halation, we proceeded to put Mr. J. I. Crabtree of Eastman Research Laboratories on the spot. Here is his interesting reply:

. . . . The white line or halo surrounding the cactuses in the appended reproduction is typical of all back-lighting effects and is caused by reflection of the sunlight by the fine prickles on the cactus. The surfaces of these behave like a mirror, and in the case of those which are inclined at the correct angle, they reflect the rays of the sun into the camera lens. This effect is, therefore, not strictly one of halation which results from image spreading.

When a dark object is viewed against a brillian light source such as the sun, an effect similar to halation is obtained which is caused by irradiation in the eye itself. The retina of the eye in this case may be likened to the photographic film. Whereas the brain should receive the impression from the retina of a sharp line separating a bright area from a dark area, the brain receives the impression of a fuzzy line. This effect is well recognized in the literature on physiological optics.

Whether we consider the light action on the retina to be a mere stimulus of the "rods and cones," or as a chemical reaction, under such extreme stimulation there is either a diffusion of the chemical reaction products or a transference of motion of the vibrating membranes to adjacent areas.

Which means that we often see those things that do not exist, which may provide a clue to those frenzied workers in the three-dimensional field.

Third Dimension

SPEAKING of three-dimensional motion pictures brings to mind the verbal spanking administered to us by Hugo Lateltin, a member of L.U. 306 and a contributor of some really worthwhile material to these columns. Subsequent to

S.M.P.E. Standards Committee O.K.'s .590 x .825 Projection Aperture

THE Standards Committee of the S. M. P. E. has officially adopted the proportions of .590 X .825 as a standard theatre projection aperture size. These figures compare with the dimensions of .615 X .820 originally proposed by the Academy of M. P. Arts and Sciences as announced in the November, 1931, issue of INTERNATIONAL PROJECTIONIST. The Society has communicated its decision to the Academy, and the matter is now in line for settlement.

With regard to the 18° mean distortion angle which was stated previously to have been an arbitrary estimate, it is interesting to note that a survey conducted by INTERNATIONAL PROJECTIONIST of 84 theatres in the metropolitan New York area revealed an average pitch of 17.5, which justifies the earlier estimate. This survey, incidentally, represents the first attempt to definitely establish the angle of projection in a large number of theatres.

In adopting the standard of .590 X .825, the S. M. P. E. followed the recommendations of the Practical Projection Committee, of which Harry Rubin is chairman, which thoroughly investigated all aspects of the situation, particularly with respect to the technical necessities of theatre presentation.

The final decision with respect to the proposed new aperture standard is expected to be forthcoming within a month.

a discussion the other day in our office (where by virtue of talking faster we dominated the situation by sheer force and number of words), Mr. Lateltin retired to the shelter of his home and there, safe from our sharp tongue, cooked up the following blast:

In the course of our discussion yesterday you expressed the opinion that in order to solve the problem of three-dimensional pictures it would be necessary to take into consideration the physiological characteristics of the eye. In support of this opinion, you stated that motion pictures were only possible due to these physiological characteristics and that on account of the "sluggishness of the eye" it was possible to "fool" the eye. You explain, therefore, the reproduction of motion pictures by saying that the present art is possible only because of the advantage taken of this deficiency of the eye. You also anticipate that the solution of the third-dimension will be proven to lie in this direction—that is, by a technical trick which takes advantage of the physiology of the eye.

This process of reasoning, although justified by the common explanation in textbooks, is not correct, as it is based on a faulty understanding of the actual process of seeing motion. To solve the problem of motion in pictures, and also the problem of the third dimension, it is not necessary to depend upon "fooling the eye." All that is necessary is to *duplicate* the physical part of the complicated process of seeing motion or depth.

When viewing motion in nature, the actual process which takes place is the same as in motion pictures, with the single difference being in the number of different pictures seen. While the motion picture camera takes relatively few positions of an object in motion, the human eye receives an infinite number. There is practically no interruption in the succession of pictures in seeing motion in nature; while when viewing motion pictures this interruption is considerable. In both cases, however, the fundamental process of viewing remains the same.

It is true that the viewing of motion depends upon a physiological characteristic of the eye in that in seeting motion the eye is "fooled." But this also applies to the act of seeing motion in nature as well as to the art of motion pictures. Motion pictures merely duplicate the physical part of seeing motion. The third-dimension will also in the same manner, that is by duplicating the physical process of seeing depth.

Inasmuch as the advantage at the moment is all with us, we had decided to let the foregoing be judged by our readers, but we shall permit ourselves one statement: By a devious route Mr. Lateltin (in his last sentence), comes back to what practically amounts to an endorsement of our position in that by stating that the trick will be turned "by duplicating the physical process of seeing depth," he confirms our contention that "duplicating" involves not matching but "fooling" the viewing apparatus of the eye. He cites further the analogy between two-dimensional and three-dimensional motion pictures and admits that in the former the eye is "fooled." We repeat, so will it be in any successful rendition of the latter.

Newspapers and Labor

THE passing of the *New York World* from the newspaper field marked also the passing of America's foremost daily newspaper labor writer and deprived the New York metropolitan area of the only newspaperman who knew "what is was all about," that is, in a labor sense. We refer to John J. O'Leary. Mr. O'Leary knew labor from A to Z; and labor men knew him. When he sat down to write a labor story he had the facts, and the background of experience and understanding, and the nerve to say what he thought. And the *World* permitted him his say, in fact, encouraged him to say it. What a difference between now and then.

No newspaper in New York now has a man who knows anything about labor. The *World-Telegram* (Scripps-Howard) is now winding up its desultory warfare against a unit of the I.A., and it must be said that, whatever the merits of its stand in the matter, it has displayed lamentable ignorance of labor and the laboring man. After firing its blast against Local Union 306 in general, its leaders in particular, and the policy of the local union as a whole, it proceeded by conventional steps to work up a lather first against then President Canavan, next against President Green of the A.F. of L. and then against the labor movement in general. We forget the terms employed to express this indignation on the part of the *World-Telegram* but we do recall that if they hadn't been silly they would have been what is termed vicious. It seemed to us that the newspaper was railing against hyprocrisy.

Well, if the battle be not against labor but against hypocrisy, why start with Local Union 306? Doesn't the *World-Telegram* know that it and all of us are operating and living in a hyprocritical age? Within five minutes in either direction from our office we can reach more than 100 speakeasies. The city, state and national governments are reeking with hypocrisy, as are a large majority of our daily newspapers. More than 30,000 speakeasies operate in New York through connivance with the authorities. We mean through graft. Local Union 306's derelections as pictured by the *World-Telegram* are infinitesimal as compared with other larger and far more important circles in which this newspaper might operate.

We have nothing to say with regard to the merit or demerit of that which the *World-Telegram* tried to do; but we do say that its labor outlook is perverted and its thinking twisted. One thing labor does stand for and that is majoriy rule, which cannot be said for government and newspapers.

Convention to Columbus

COLUMBUS, OHIO, has been chosen as the scene of the next (31st) Convention of the International Alliance. While no details have been settled as yet, it is expected that the Convention will be held the latter part of May, as heretofore. Other cities which received consideration were Louisville, Kentucky, and Milwaukee, Wisconsin.

CLEANING SOUND SCREENS

CONSIDERABLE misinformation regarding the cleaning of sound screens has been broadcast recently, particularly in house organs of motion picture companies. Projectionists are in accord as to the necessity for cleaning sound screens, inasmuch as perforations clogged with dirt result in very unsatisfactory sound. Some of the methods suggested recently, however, bring to mind the old bromide about the cure being worse than the disease, and not a few screens have been irreparably damaged as a result of improper cleaning methods.

It is reiterated here that there is no satisfactory method of cleaning a sound screen, despite the claims of many manufacturers that screens may safely be washed.

Non-Uniform Results

From the purely technical angle, it is impossible to wash a screen. The fabric itself is washable and can be cleaned very easily, but it is almost humanly impossible to remove all of the dirt from so large an area as that of a motion picture screen, evenly and uniformly, without leaving streaks.

The question of cleaning resolves itself down to the ability of an individual to remove the dirt uniformly from a large area. The particular cleanser used has very little bearing upon the subject as a screen can be washed with equal results with any realiable soap dissolved in warm water and the solution applied with a sponge and the screen rinsed off with clean water. Good results apply only to small areas, however.

Every major circuit has devoted a great deal of time to cleaning of screens. Up to date the most satisfactory means found is to brush off the screen with a fine goat's hair brush at least once a week from the time it is installed. In this way the surface can be kept fairly free of dust. In case a vacuum cleaner is available, excellent results can be obtained by reversing the action of the cleaner and blowing the dust and dirt off the screen from an angle.

The PATENT PAGE

Edited by
H. L. Burkitt

THE following digest of patents granted recently was prepared exclusively for INTERNATIONAL PROJECTIONIST by Henry L. Burkitt. Mr. Burkitt, B.S. in ch. e., L.L.B., is a former Assistant Examiner in the U. S. Patent Office, a member of the Bars of New York, Pennsylvania, and the District of Columbia, practising in New York City. Any reader desiring information on any patent, whether abstracted herein or not, or wishing to secure a copy of any patent listed herein, may secure same by addressing Mr. Burkitt in care of this publication.—*Editor.*

. . . not "clips" in wordy patent language but clear and concise abstracts prepared especially to meet the needs of readers of this publication.

Volume Control

1,827,735. *Volume Control In Sound Record Reproduction, to James R. Balsley; assigned to Fox Film Corporation.*

In this sound control system using sound film, a separate record is moved synchronously with the sound record to produce electric currents and thus effect volume variations of the sound reproduced from the sound record. This film control is associated with the gridplate circuit of a vacuum tube in such manner that the control currents may be modulated by the sound currents.

Automatic Disc Stop

1,828,171. *Phonograph Sound Reproducer, to James R. Buchanan.*

Apparently this disc record sound reproducer has stop means for the turntable including a light-intercepting device which is moved by a screw, connected to the turntable drive shaft in such way as to stop the record at a certain point. It is not clear for what purpose light intercepting and responsive devices actually are provided.

Condensing System

1,828,399. *Photo-electric Cell Light Ray Condenser, to Charles W. Ebling; assigned to General Talking Picture Corporation.*

In a block which is used for guiding film past a photo-electric cell, is mounted a removable tube carrying a condensing lens. A slit is provided for guiding rays to the lens.

Vacuum Tube

1,828,545. *Vacuum Tube and Its Elements, to Samuel Ruben; assigned to Ruben Tube Company.*

A sealed evacuated envelope contains a grid, an anode, an indirectly heated cathode, and a heating element for heating the cathode. The cathode has a coating of alkaline earth oxides, and the filament is mounted upon a conductive member having a specific resistance greater than that of the conductive filament.

Film Stopping Apparatus

1,828,569. *Film Stopping Apparatus, to Edward W. Kellogg; assigned to General Electric Company.*

The reel for the record film has a flange portion and a relatively rotatable hub portion upon which the film is wound. Means respond to predetermined unwinding of the film to stop further movement of the flange portion.

Sound Screen

1,828,749. *Motion Picture Screen, to Albert L. Raven.*

The screen is made up of a plurality of wavy horizontal strips, each arranged with its upper edges overlapping the lower edge of the next higher strip. The peaks of the waves are disposed opposite one another. Means secure the strips to one another at the peaks so as to provide, between the points of attachment, numerous sound passages, extending upwardly from the rear toward the front of the screen.

Sound Correction

1,828,941. *System For Correcting Sound Records, to Roy J. Pomeroy.*

In this method, the original sound film is audibly reproduced. A distortion record of this reproduced sound is made by synchronously producing currents from the original and the distorted records, and the sound currents so obtained are differently combined so that the sound currents are neutralized except for a distortion-representing current. The original record is then corrected by modifying it by means of the correction record by the amount of and opposite to the distortion arising in reproduction.

Sound Correction

1,828,942. *Production Of Corrected Sound Records, to Roy J. Pomeroy.*

In this method, sound is recorded both photographically and mechanically. The mechanical record is then audibly reproduced and a representation of the distorted sound thus produced is differentially combined with a representation of the original sound to get a distortion record. The original photographic sound record is then combined with the distortion record to effect negative distortion and get a distortion compensated mechanical record, that is, the final mechanical record is distorted negatively to the distortions ordinarily produced, and thus distortion is completely cancelled.

Air-Blast Reproducer

1,829,801. *Sound Reproducing System, to Warren C. Jones; assigned to Bell Telephone Laboratories, Inc.*

A disk record has means arranged in conjunction therewith and in advance of the reproducer, for blasting a cooling current of air upon the disk surface to harden it before it is acted upon by the reproducer.

Stringed Speaker

1,829,909 and 1,829,910. *Stringed Loud Speaker, to Chakir Midhat.*

The speaker includes a plurality of strings, stretched over, and attached at one end to, a resonant body. At the other ends of the strings is freely suspended a disk. This driving unit is coupled to the disk and thus acts to vibrate the strings.

Combination Film

1,829,912. *Combined Sound And View Film And Method Of Making The Same, to Douglas G. Shearer; assigned to Metro-Goldwyn-Mayer Corporation.*

The sound record and the picture film are on two strips and are secured together along their longitudinal edges. These edges are formed in stepped relation for interlocking, and are cemented together along these edges.

Film Trap and Door

1,830,158. *Film Trap and Film Trapdoor, to Augusto Dina; assigned to the Precision Machine Co., Inc.*

A film trap carries bodily a movably supported door. Means are provided for propelling the door to closed position while impact means for absorbing the closing shock are disposed in opposite relation to the door.

1,831,346. *Compound Base For Motion Picture Projection Machines, to Augusto Dina; assigned to International Projector Corporation.*

A base normally adapted to rest on a floor is provided with means for tilting one of its ends.

Lamphouse Support

1,830,537. *Lamp Support For Projection Machines, to Louis Simon Frappier and Ewald Boecking; assigned to International Projector Corporation.*

A rotating member is provided in connection with the telescope by means of which any one of a plurality of lamps may be positioned in relation to the telescope; when so positioned, only that particular lamp is energized. Detents are provided for securing the sockets in relative relation to the telescope. (See patent following.)

Improvement For Same

1,830,538. *Support For Light Sources, to Louis Simon Frappier and Ewald Boecking; assigned to International Projector Corporation.*

This improvement on the preceding patent provides curved shanks in each socket, these shanks being secured by set screws to a rotating sleeve carrying the sockets and having apertures larger than the said screw so that variable adjustment may be obtained.

P. E. Cell Process

1,831,314. *Photoelectric Tube, to Archie J. McMaster and Charles E. Parson; assigned to G-M Laboratories.*

The cathode of the cell has an alkaline metal deposited and oxidized on it, the excess metal being expelled during oxidation.

PROPER SHIELDING FOR ELECTRIC CIRCUITS

John G. Ferguson

MEMBER OF THE TECHNICAL STAFF, BELL TELEPHONE LABORATORIES

IN ITS simplest form a condenser consists of any two conductors separated by a dielectric. It follows, therefore, that since air is a dielectric any pair of neighboring conductors will act as a condenser, and current will flow from one to the other when a varying potential is impressed across them.

In circuit design this capacity effect may be objectionable for two reasons. It makes the value of any impedance dependant on its surroundings, and also the stray current through the capacity may flow into other parts of the circuit, causing objectionable interference. Such stray capacities may be eliminated either by separating the various parts of the circuit sufficiently to reduce the effect to negligible proportions, which is usually impracticable, or by introducing a shield between the conductors.

Although shielding eliminates the capacity that depends on position it introduces a capacity of its own which is of greater magnitude. This is partly because the shield is larger than the conductor but chiefly because being between the conductors it is nearer to both. Shielding, therefore, does not offer a simple and complete solution of the problem. Careful consideration must be given in each case to the effect of the capacity introduced, and a shielding scheme adopted which will give the best overall result.

Elementary Principles

Certain of the elementary principles involved can be illustrated by a few simple circuits. With the single impedance of Figure I-A, for example, there is a capacity from different parts of the conductor to other parts of the circuit and particularly to ground, as indicated by the dotted condensers. These capacities affect the impedance between terminals, and since they vary with the location of the impedance, the value of the impedance is variable, and is known only for the location in which it is measured.

By placing a shield around the impedance and connecting it to one point of the circuit, as shown in Figure 1-B, the capacity between impedance and the shield remains the same regardless of position, and as a result the value of the impedance is also independent of position. There remains a variable capacity between the shield and ground, but this capacity is concentrated at the single point A and may be readily measured for any position and allowed for. If it is possible to ground the terminal A, all capacities that vary with position are avoided.

If the impedance of Figures 1-A and B is adjustable, the capacity to the shield will differ for each setting but a calibration may be made once and will hold regardless of the position of the impedance, since the capacities to the shield do not vary with position. The same method of shielding may be applied to any number and arrangement of impedances, provided there is only one control, since for any setting the value of the capacity to the shield will always be the same.

If there is more than one method of adjustment, however, that is, if two or more parts of the impedance can be varied independently, the adjustment of one part changes the effect of the shield on the other. With two impedances inside a single shield, as shown in Figure 1-C, the distributed capacity between CB and the shield is in parallel with the impedance AC through CB. If the value of CB is adjusted, therefore, the value of AC will vary because of the change in the overall impedance from CB to the shield.

Types of Shielding

To avoid this condition, separate shields may be placed over each impedance, with that over AC connected to the point A, and that over CB to the point B, as shown in Figure 1-D. With this arrangement changes in the setting of either AC or CB may be made without affecting the other, but there will exist an additional capacity—that between the shields of AC or CB, which depends on

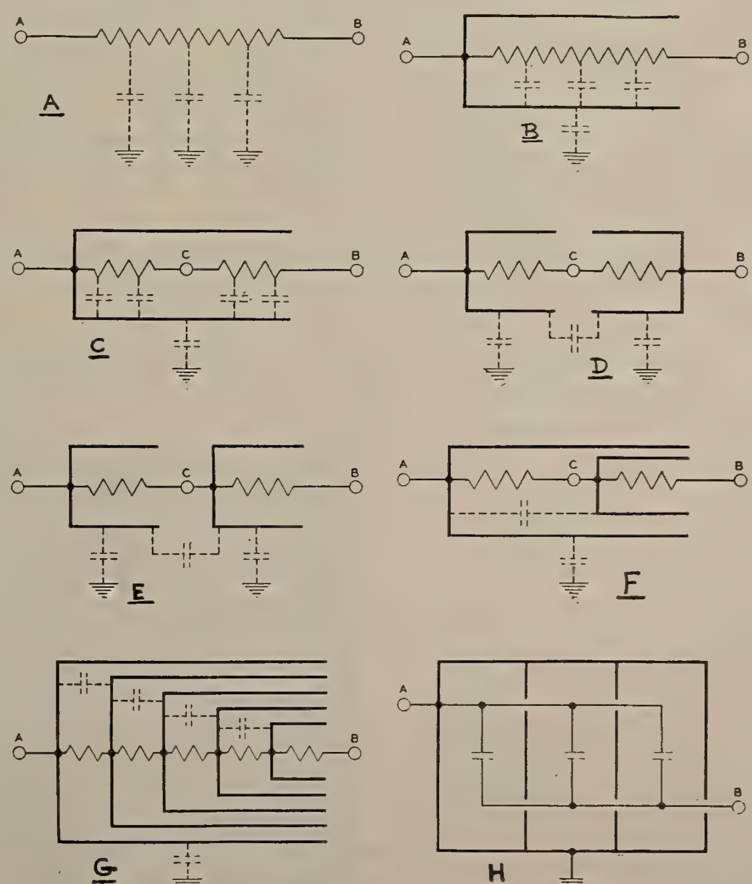


Fig. 1.—Various shielding arrangements for an impedance or a group of impedances connected in series or in parallel

position. This capacity is slightly more objectionable than capacity from shield to ground since while either A or B may be grounded, both points may not, so that there will always remain a capacity from one shield to ground which will vary with position.

An alternative arrangement of the shields for such a circuit is shown in Figure 1-E. The variable capacity between shields remains, but it is across one impedance only. If now the shield connected to A were extended to include the other, as shown in Figure 1-F, the only capacity that varies with position is that from the outer shield to ground. If the outer shield is grounded there will be no capacities that vary with position.

The extent to which the capacity between shields is objectionable depends on the form of the impedance between A and C. If it is a capacity, that across the shields is merely an addition to it and is not objectionable. If it is a resistance, however, the capacity between shields increases its phase angle, while if it is an inductance, the shield capacity increases the variation of inductance and effective resistance with frequency. The principle may be extended to include any number of variable series impedances, the effect being to place a capacity across all but one and to enclose the whole in an outer shield. Such a system for five elements is shown in Figure 1-G.

The shielding of variable parallel impedances is comparatively simple since each or any number may be shielded individually and all the shielding connected to the same point. This may be reduced to the form of a single shield with partitions to separate the individual elements from one another. Figure 1-H indicates the arrangement for three capacities in parallel. By a combination of these two methods it is possible to shield any combination of series or parallel impedances so that all capacities from the shielded elements to external conductors will be concentrated at junction points or terminals, one of which and only one, may be grounded. The determination of which terminals the various shields should be connected to, and the terminal that should be grounded, depends on various conditions and no general rules can be given.

PHILOSOPHIC BACKGROUND OF UNIONS

Sumner H. Slichter, Ph.D.

UNDOUBTEDLY the greatest objection to labor organizations on the part of management is that they interfere with efficiency. To this objection there are several answers. One is that there are other things which are no less important than efficiency. Among them are security and liberty. Indeed, in view of the rapid rate at which we have been increasing per capita productivity during the last hundred years and our failure to make progress in the achievement of security, it is reasonable to conclude that security today is far more important than efficiency. We could well afford to exchange some of our efficiency for more security. And the same holds true for liberty.

Whether or not trade unions interfere with efficiency, they are the only means by which the workman in the vast enterprises of modern industry can acquire liberty and security. They are the only way in which he can effectively bargain over whether he shall work six days a week or five, or whether he shall be paid by the piece or by the hour, over whether a change in conditions warrants a change in his piece rate. Likewise they are the only means through which the workman can acquire security, through which he can prevent the management from discharging him whenever it wishes.

Liberty a Result of Security

To a substantial extent, security and liberty go together, for liberty is partly a result of security. Only when men are protected against arbitrary discharge, dare they to express their aspirations, ideas, and grievances without dread of being heard by the foreman.

Only through security do they acquire opportunity to criticize the management, to find fault with the way the plant is run, to talk freely about how they think it should be run—in other words, to express the same sort of ideas about the management of the plant that free citizens are accustomed to express about the government of the country.

If these things interfere with production, the answer must be that they are well worth the cost.

No General Rule

With the above procedure it is possible to make the impedances independent both of position and of each other. It must be remembered, however, that troublesome capacities have not been eliminated. Fixed capacities have been substituted for variable ones but in general they are larger, and if the substitution is at too great a price in the way of an increased total capacity, the improvement may be questionable. In practice it is necessary to consider each case individually for the best results.

One of the most important capacities that varies with position is that between a unit and the operator's hand that may be moving the dial to adjust it. In a resistance box, for example, the first requirement, therefore, is that the whole group of units be enclosed in a shield that completely covers the top so that there will be no variable capacity between the hand and the various resistances. If there is only this one outer shield, there will still be variable capacities between resistances which will vary with the settings of the dials.

Although nested shields, as shown in Figure 1-G, would eliminate these variable capacities, in many cases the high additional capacities they introduced would be more objectionable than the capacities between resistances, which are generally negligibly small except for high-resistance units. For most cases even the highest resistance units do not need individual shields.

With adjustable inductances the size of the coils is usually much greater than with resistances, so that individual shielding is more important. Because of the difficulty of bringing the various dials through a series of successive shields, however, and of the large size of the units, three dials represents about the maximum number that can be shielded in this way.

Shielding is usually simplified with condensers because they are connected in parallel. Such a connection seems as a rule to confine all stray capacities to the terminals of the condensers. It is not necessary, experience has shown, to place shields around the individual dials of mica condensers, since the capacity between them is small compared to the value of their smallest unit. Because the capacity of the air condenser is smaller than that of the mica condensers, however, it is enclosed in an individual shield.

Attention!

The article on page 16 is directed at you, Mr. Reader—written and printed solely for your benefit. No article is worth the space it accupies unless it provokes thought and inspires action. What is your estimation of and reaction to the article on page 16?

NOTES *from the* SUPPLY FIELD

★

COMPLETE ALL-A.C. SYSTEM BY PACIFIC RESEARCH

COMBINING modern engineering practice with simplicity of design and operation, the new all-A.C. sound system developed by Pacific Research Laboratories of Los Angeles seems destined to win instant favor in the sound reproduction field. This equipment, known as the P R L Type 9-AC system, was designed primarily for those theatres having a seating capacity up to 1,200 seats.

This unit provides all the equipment necessary between the photo electric cells and the stage horns at the extremely reasonable price of $200, which makes this system one of the most inexpensive outfits on the market. Numerous speaker equipments to complete the chain are available at a very moderate price and serve to keep the overall cost within the moderate budgets of most small theatres.

The 9-AC system is a complete and self-contained power supply and high-gain amplifier which gives splendid results in sound-on-film reproduction, and laboratory tests of the equipment have demonstrated its performance to be on a par with the best reproducing units available today. The equipment, being comparatively small, is placed between the projectors, with connections to the photo electric cells, exciter lamps, horns and the A. C. line being brought in to a marked terminal strip through knockouts provided in the sides and bottom of the cabinet.

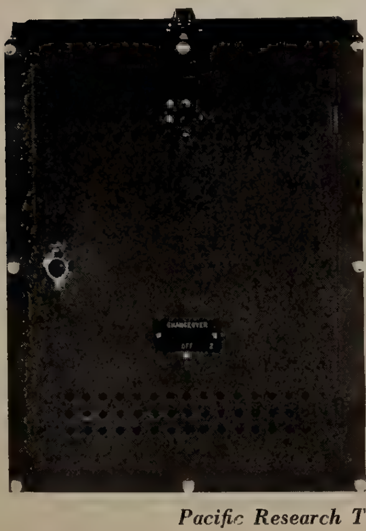
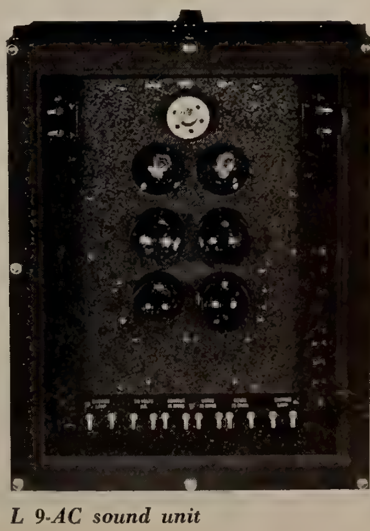
This equipment is equipped with a new type transformer which supplies the current to the exciter lamps without the aid of filtering, in addition, of course, to supply current for the photo electric cells.

Extreme Simplicity

Controls are mounted in the top and front of the cabinet, thus insuring convenience in operation. These controls include a volume control and sound change-over switch. The extreme simplicity of the whole equipment makes for easy operation at all times and makes the matter of servicing, if necessary, relatively easy.

In this connection, the manner of mounting the amplifier and associated apparatus (as shown in the accompanying illustration), is worthy of note. These are mounted on a steel panel which makes it possible to remove the entire assembly from the cabinet without disturbing the conduit connections from the cabinet to the sound heads and other apparatus. For quick inspection and servicing one need not be bothered with a maze of wires and connections. All parts are standard and interchangeable.

The low price of this sound system does not reflect the quality performance of the equipment, the price being the result of modern engineering, manufacturing and distributing facilities rather than of inferior materials or design. This statement is borne out by performance records. Special voltages may be had upon application to Pacific Research Laboratories, 1,907 Fourth Avenue, Los Angeles.

Pacific Research Type P R L 9-AC sound unit

VARO-FOCUS PHOTOGRAPHIC LENS BY B. & H.

BELL & HOWELL has announced a new photographic lens that opens up a wide range of new possibilities and spectaoular effects. The new Varo lens is set to focus on a definite position and is not focused like the ordinary lens by moving the lens unit nearer to and farther from the film. It is set normally to focus at 150 feet to infinity. Supplementary lenses, screwing into the front of the lens, are available for changing the focus for other distances.

Smooth Changes

After focusing, various elements in the lens are moved in a synchronized relation, the focal length changing in smooth progression as the position of the elements are shifted. Even though these elements are changed continuously, the definition is critical at all points.

Shifting is by means of cams designed and cut to an extremely fine degree of accuracy. Since changing the focal length or magnification involves changing the iris continuously to correspond, the iris diaphragm is also operated by a cam at the same time as the lens elements. A locking arrangement and dashpot device in the iris mechanism avoids any possible damage to the iris due to incorrect operation. A "breather" takes care of displacements of air occasioned by moving the lens elements.

NEW ARC CURRENT CONTROL BY CUTLER-HAMMER

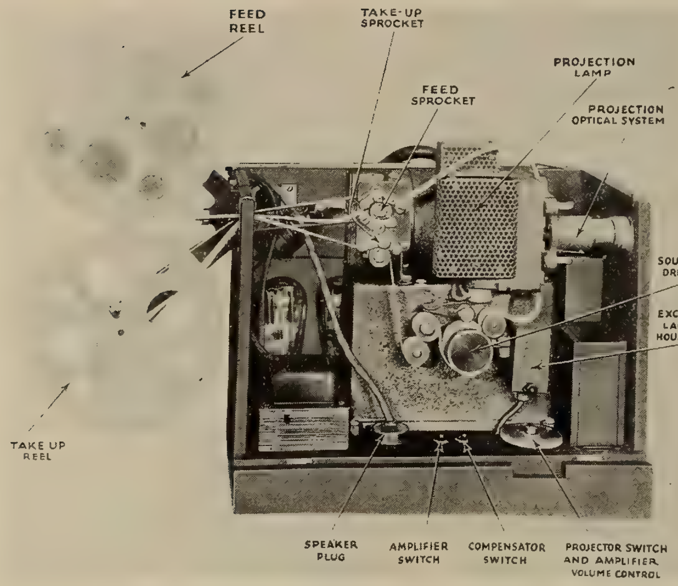
A NEW automatic current controller for arc projection machines, designed to replace the usual knife switches used to control the current to the carbons of the projection machine, has been put out by Cutler-Hammer, Inc., of Milwaukee.

The controller proper can be mounted with the resistor in any out-of-the-way place. Only the push-button master switch is mounted on the machine, near the projectionist. By simply pushing the "start" button of the master switch, the projectionist obtains a low current for warming carbons. Then after a definite time interval the transfer to high current for normal projection can be made by pushing the "run" button in the master switch. The definite time interval (about one second) which must expire before the projectionist can transfer from low or starting current to the high running current, assures that the carbons are sufficiently warm, thereby preventing sputtering.

PORTABLE FILM CLEANING MACHINE INTRODUCED

THE National Film Renovating Co. of New York has introduced a portable film cleaning machine. Wholly automatic in operation, the cleaner weighs but 22 pounds, including the motor. The device includes a casing comprising an upright box-like section, closed at the top, bottom, sides and back. It is entirely open at the front. A pair of doors hinged at the opposite sides of the casing section serve to fully close the front.

The entire cleaning mechanism, together with the reels for the film, is enclosed in the casing. An electric motor and power transmission mechanism for operating the cleaning mechanism and



Mechanism of RCA portable 16 mm. projector

for rotating the film reels are mounted upon the exterior of the casing at the back. Feet serve to support the casing upright. The machine is a compact portable unit designed for standing upon a table or any other elevated support.

16 MM. SOUND-ON-FILM RCA EQUIPMENT

ANNOUNCED as the culmination of four years of intensive development and heralded as the most advanced step in the field of sound reproduction RCA Photophone, Inc., and the RCA Victor Company have introduced a new all-AC operated 16 mm. sound-on-film motion picture projector.

RCA Victor Product

Manufactured by the RCA Victor Company at its plant in Camden, N. J., and referred to as the RCA Photophone Junior Portable to distinguish it from the 35 mm. Senior Portable which has been on the market for more than a year, the new machine gives rather an amazing performance when its own dimensions and the dimensions of the slender thread of film used are taken into consideration. With the projector placed about 30 feet distant from the screen and the loudspeaker behind the screen, a picture about 4 feet by 6 feet in dimensions and sound of excellent quality are reproduced with remarkable fidelity.

The RCA Photophone Junior Portable equipment consists of a projector-amplifier unit and a small loud speaker unit. The entire equipment is operated from any 110 volt, 50- or 60-cycle A. C. lighting circuit.

Showing extreme portability

Specifications

The projector-amplifier unit is 14½ inches long, 13¼ inches high, 8¼ inches wide and weighs 43 pounds. The equipment is not removed from its case during operation, the interior mechanism being readily accessible for such adjustments of the projector, replacement of radiotrons, lamps and photocells as may be required. During the actual presentation of sound pictures, the case is closed to reduce to a minimum extraneous noise caused by the operation of the projector mechanism. The projector is equipped with an optical system which projects pictures varying in size from 22 inches wide x 16 inches high at a distance of 10 feet; to 67 inches wide x 50 inches high at a distance of 30 feet. The picture size recommended for good illumination is 52 inches wide x 39 inches high. This size is obtained at a projection distance of 23 feet.

The exciter lamp is a 4-volt, .75-ampere, incandescent lamp and the radiotrons used in the amplifier are one UX-868 photocell, one UY-224, one UY-227, three UX-345s, and one UX-280. All power for the operation of the loud speaker is obtained from the projection-amplifier unit.

Ample Volume

The loud speaker is mounted in an individual carrying case which is 19 inches long, 16 inches high, 9½ inches wide and weighs 21 pounds exclusive of film cases, film reels and film. Space is provided in the case for the storage of eight film cans for 400-foot film reels. This loud speaker is of the flat baffle type with the dynamic speaker unit mounted behind the screened opening in the front of its carrying case. A sufficient volume of sound is available to meet the requirements of rooms having a cubic content up to 10,000 feet.

The 16 mm. film employed for the reproduction of sound pictures by the Junior Portable contains sprocket holes on one side only instead of both sides as are required by the 35 mm. film. When threaded into the projector, the sprocket holes are on the right side of the film. The sound track, barely discernible to normal sight, is at the left.

W. E. vs. AMPLION OF A.

Western Electric has obtained a permanent injunction against the Amplion Corp. of America and the other defendants in its patent infringement suit as the result of a consent decree entered in the Federal Court, Southern District of New York. The decree sustains both the validity and infringement of the W. E. patents, the Wentes and Harrison patents covering inventions used in loud speakers for talking picture reproduction.

In return for the waiving of other than nominal damages by W. E., it is agreed that all infringing equipment in the defendant's possession shall be turned over. The waiver, however, does not restrict the rights of W. E. to bring suit against any theatre equipped with the infringing apparatus.

[EDITOR'S NOTE: *The Amplion Corp. of America should not be confused with Amplion Products Corp. of New York City.*]

RCA PHOTOPHONE-RCA VICTOR CONSOLIDATION

RCA Photophone, Inc., which has functioned as a separate corporate entity heretofore, has been consolidated with the RCA Victor Corp., of Camden, N. J. This move is the latest step in the unification of activities of the Radio Corporation of America and its affiliated subsidiaries.

Removal of the RCA Photophone, Inc., laboratory equipment, office furniture and all records of the company has already been effected. RCA Photophone will maintain a contact office in New York at 411 Fifth Avenue.

PROTEST THEATRE TAX

The I.A. General Office has been deluged with copies of communications sent by the local organizations to their Congressmen and United States Senators, as well as the replies received, in opposition to the proposed theatre taxation as presented by Secretary of the Treasury Mellon, in a concerted effort to have this measure defeated. The theatrical industry as a whole is protesting against the proposed restoration of the war-time admission taxes, due to the unsatisfactory condition of the industry at the present time. The tax proposed by the Administration is 10 per cent, on all admissions above ten cents.

Urge Support

Any local union who has to date neglected to communicate with their Congressman and United States Senators, as requested, are urged to immediately see to it that such detail is carried out in support of this worthy cause.

S.M.P.E. PROJECTION COMMITTEE WORK INVALUABLE—GOLDSMITH

THE work of the Projection Practice Committee of the Society of Motion Picture Engineers, when completed, will be a valuable contribution to the motion picture industry, according to Dr. A. N. Goldsmith, president of the Society, who attended a recent meeting of the committee.

"When I recall that the driver of a five hundred dollar automobile has at his command an oil guage, a speedometer, an ammeter, a radiator thermometer, and what not, with which to 'Feel the pulse and take the temperature' of the machine continuously while operating it, I look with astonishment and sympathy at the projectionist, who is obliged to project pictures night after night before a one-thousand-dollar-box-office house, in a two hundred thousand dollar theatre, literally, as it were, in the dark, and partially ignorant of the condition of the projector until its condition becomes so bad that the effect is seen upon the screen and is heard in the sound," said Dr. Goldsmith at the meeting.

Audience Reaction

"Then it is too late—the audience has seen the effect, consciously or unconciously, the audience carries away a feeling of dissatisfaction, the magnitude of which depends upon the seriousness of the circumstance, and may look elsewhere for better pictures and better sound.

"When the Projection Practice Committee will have completed its work of determining all the tolerances, clearances, and tensions for all moving parts of the projector, as it has set out to do, and of determining the amount of wear to which these parts may be subjected with safety, it will have completed an invaluable piece of work.

"But the final economic results of the work will have been achieved when the Committee successfully indicates the simple means to be used by the projectionist to check these things, and the design of a cheap and simple kit of tools which he may use to do so. The Society of Motion Picture Engineers should do its best to make it easy for the projectionist to determine the exact condition of the projectors and to prove the occasional and timely need for replacement parts to the properly economical exhibitor. This means money in the exhibitor's pocket through better audience reaction, and also a more satisfactory and dignified position for the projectionist.

"Flicker, shaking of the picture on the screen, out-of-focus effects, poor sound reproduction, all of which can be caused by the wearing or the maladjustment of parts, will then be under the control of the projectionist, who will be able to check and to readjust or replace the faulty parts before they are allowed to annoy the audience, irritate the theatre owner, and drive away the patrons.

Selling Entertainment

"For it is axiomatic that every business, to be successful, must serve the interests of the customer—the object of the motion picture theatre is to sell entertainment to its patrons, and everything that can be done to improve this product (the entertainment), will serve not only to maintain this patronage, but to increase it."

In addition to the study which forms the subject of Dr. Goldsmith's remarks, the Committee is working on such problems as the determination of screen brightness in relation to its effect upon the audience, and the advisability of stopping down the projector lens when projecting cartoons and other bright subjects, or otherwise getting the same effect; and the design of suitable apparatus for equalizing the sound outputs of the two projectors, so that no difference in sound level will be discernable by the audience when the change-over occurs.

The successful progress of the work of the Committee is due largely to the efforts of Messrs. Harry Rubin, Chairman, Jesse Hopkins, H. Griffin, F. H. Richardson, P. A. McGuire, J. O. Baker, S. Glauber, and George Edwards.

Elements Necessary for Good Reproduction

WHAT are some of the elements which are necessary in order to achieve the illusion of reality in a sound picture presentation? First, in speech presentation the words should be understandable, one from another, and they should all sound like the speech of human beings. There are very few persons whose voices sound exactly alike, and it is often the case that certain types of sound apparatus may render the speech of the various characters in a sound picture quite intelligibly, yet with little difference between the voices of the various men or women in a picture and with voice quality that no human being ever possessed.

In music the distinguishing feature of natural sound reproduction is the fact that all of the instruments in a full orchestra can be clearly distinguished one from another. In addition, there is a great width of tonal range, so that the lowest bass notes and drum beats can be heard as clearly and loudly as the highest tones of a violin.

Uniform Reproduction

Further and even more important is uniformity and evenness of reproduction. By this is meant equal loudness of the various tones of the musical scale. Poorly designed equipments (particularly loudspeakers), are frequently marked by the fact that as the music goes up or down in pitch certain tones will stand forth violently while others can scarcely be heard. This difficulty is due to what is called "resonance peaks" in the loudspeakers.

In addition to the general characteristics outlined above there is a characteristic which is common to both speech and music, and that is smoothness of individual speech sounds or musical tones. By this is meant freedom from tremolos or additional fuzzy, raspy or other types of harsh noises accompanying the words or music.

Complete naturalness of reproduction requires that all equipment be capable of recording and reproducing a very considerable percentage of all sounds which the human ear can hear from the lowest to the highest tones. The extent to which this is done is called the "frequency range" of the equipment.

Notes

C. M. Fowler is the new president of Chapter 7, American Projection Society, located in Los Angeles. Fowler succeeds Sidney Burton. Emil W. Lindholm is the new secretary.

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Officers of L. U. 640 (Nassau and Suffolk counties, N. Y.), for the coming year are: president, Joseph Engle; vice-president, M. D. O'Brien; business manager, Frank Cummings; secretary, Rodney Titcomb; treasurer, Dave Peshkin.

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Independent M. P. Operators & Service Engineers Ass'n of the U. S. A., Inc., an open shop union that claims 800 members throughout the country, now is in Minneapolis. Officers are: William H. Gage, president; Burt Carlisle, vice-president and business manager; M. J. Gilfillan, secretary.

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Thad Barrows has been re-elected president of Boston Local Union 182 for another term. Other officers elected were business agent, James F. Burke; Albert Moulton, financial secretary; Joseph Rosen, treasurer; Maurice Adelson, John Fulleck, and Bernard McGaffigan, directors.

Barrows, who is president of Projection Advisory Council, was unopposed in the L. U. 182 election.

D. C. POWER SOURCES

(*Continued from page* 15)

article will compare these various uses and economies of many systems employed to supply this direct current.

We learn from a study of electrical theory that there is only one actual source of direct current and that is batteries. Any device that has been used as a battery substitute (and most all of them have been designed from the angle of economy), do not furnish actual direct current but the next *nearest equivalent*—which is pulsating direct current, raw or filtered, or rectified alternating current, filtered or unfiltered.

If the noise component measured in units of sound (which is an inherent part of all d.c. substitute devices), can be kept below the minimum level, depending upon the type of equipment used and the volume standards of sound picture production, or the point where it will not be additive to the reproduction volume, such a device can be adapted as a direct current substitute.

Purely a Substitute

In doing so, however, we immediately reduce the standard of sound transmission by the acceptance of economical tolerances. Should any of the constants required for generation, rectification, and filtering in those substitutes accidentally alter their physical or electrical status, our entire set-up becomes disrupted and reproduction is marred by commutator ripple, A.C. hum, rectifier hum, and so forth.

Batteries Best

So, getting down to brass tacks, if we must use direct current, there is only one kind to use and only one place to get it. If we use another kind of current as a *substitute*, we do it for economical reasons and therefore must be satisfied with the results. Such results this writer holds to be only an *imitation* of the best.

The foregoing is also true of rectifier current for use at the arc.

I should like to add that this statement is not primarily a criticism of Mr. Bagno's article as presented herein but rather a rebuttal of the argument that anything other than a storage battery will give us that type of current which it is admitted we must have. It might be added, whether fairly or unfairly, that Mr. Bagno's article seems to favor rectifiers.

[NOTE: *Additional comment regarding the foregoing presentation of data relative to sources of power supply are invited*—EDITOR.]

NEW STUDIO AGREEMENT TO HOLD UNTIL 1934

A SUCCESSION of conferences, commencing Monday, January 11th, and terminating Friday, January 15th, resulted in practically the ratification of the West Coast Studio Agreement, which had expired on November 29th, 1931, and was extended to January 11th by mutual agreement.

These meetings were held in the offices of the Vandeville Managers' Protective Association, 1600 Broadway, New York City, and were attended by the following representatives of the various theatrical interest: Harry Warner, of Warner Brothers Theatres, Inc.; Nicholas Schenck, of Loew, Inc.; Major L. E. Thompson, of Radio - Keith - Orpheum; Sidney Kent, of the Paramount-Publix Corporation; an official of Universal Picture; Pat Casey, Chairman of the Producers' Committee, and Al Berres, Secretary of the Producers' Committee. The

affairs of the different labor organizations were handled by H. C. Fechner of the International Association of Machinists; E. D. Beritz of the International Brotherhood of Electrical Workers; L. P. Lindelof of the International Brotherhood of Painters, Decorators and Paperhangers of America; A. Muir of the United Brotherhood of Carpenters and Joiners of America; Joseph N. Weber of the American Federation of Musicians; William C. Elliott of the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators of the United States and Canada, and Frank Carothers, Secretary of the Internationals' Committee. Several other officials of the various crafts were also in attendance, among them International Representative Walter S. Croft of the International Alliance.

Minor Changes

Renewal of the agreement in its entirety, admitting only of several minor changes affecting the Cameramen's Local organization, was obtained with the understanding that all crafts will continue working on this agreement as at present in force, pending adjustment with the Cameramen. The new agreement will be in operation until January, 1934.

Inasmuch as the Laboratory Technicians, Local No. 683, was formed since the last Studio Agreement had been executed, additional clause was inserted, providing for their inclusion in the new agreement. No consideration or recognition would be given by the Producers to making the Film Editors and Cutters parties thereto.

Also an alteration occurred in the Basic Studio Agreement as a result of the withdrawal of the International Brotherhood of Painters, Decorators and Paperhangers of America when the Producers refused to recognize their four different departments. This action leaves but four remaining crafts in the Basic Agreement—the Electrical Workers, Carpenters, Musicians and the Alliance. Provision was made, however, that should the Painters desire to reconsider and again become part of the agreement, there will be no objection from any source.

Locals Concerned

The General Office is very grateful for the co-operation accorded them by the delegation from the West Coast in behalf of the five I.A. organizations affected: Moving Picture Machine Operators, Local No. 150; Studio Mechanics, Local No. 37; Laboratory Technicians, Local No. 683; Sound Technicians, Local No. 695, and Cameraman's Local No. 659, who very ably and efficiently handled the affairs of their particular local unions and were tireless and unceasing in their efforts to clearly and adequately present their individual situations.

Final disposition of the Camerman's situation will be taken up by President William C. Elliott and First Vice-President John P. Nick when they shortly join International Representative Walter S. Croft on the West Coast. Croft has been handling the Studio situation off and on for the past two years.

NEW DEVELOPMENTS SPUR ACOUSTIC ART

INSTRUMENTS for use in connection with acoustic studies have been developed in the Bell Telephone Laboratories for use by Western Electric Co. which have aided mightily in correcting and providing for the proper rendition of sound in auditoria. Out of the studies of many auditoria have come certain definite facts concerning the action of sound waves which are of great interest and importance in the evolution of the acoustic art.

In a "live" room, one with walls only slightly absorbing, the sound wave makes many trips about the room before it is completely absorbed. In a "dead" room, on the other hand, one with walls highly absorbed. the wave makes only a few

trips before its energy is entirely exhausted.

Each component wave element of sound in an auditorium has a definite period of life which begins when that wave is given off by the source of sound, and ends when its intensity falls below what is known as the threshold of hearing. During this life period of any one sound wave, its intensity decreases in steps—falling a constant proportion with each reflection.

Total Room Energy

The total sound intensity in the room is the summation of the waves just sent out by the source and the various trains of waves which have been reflected and re-reflected from the walls and fixtures in the room. From the beginning of emission of sound to the first reflection, the intensity of the sound in the room is that of the direct waves; from then until the second reflection it is that of the direct wave train plus the contribution of the reflected waves.

This building up of the intensity continues until there have been so many reflections that the intensity of the first emitted wave is negligibly small.

There is a definite period, therefore, before the sound intensity* in a room reaches its full value. The source is constantly emitting new sound waves and each wave is being reflected back and forth from the walls and fixtures and, although losing part of its intensity at each reflection, is adding its remaining portion to the sound already in the room.

This period of building-up is thus equal to the time required for any one wave to have been reduced, by reflection, to an intensity below the threshold of hearing, that is, to that intensity which will no longer add an audible component to the sound already in the room. It is thus the life of a single sound wave that determines the time required for the sound in a room to attain its full strength.

Wave's Life Span

In a somewhat similar manner the life span remarks off the period between the cessation of sound emission and the actual disappearance of the sound. When a source is cut off, the last emitted wave will have its full life span to live, and a certain wave will have just reached its death level. From this time on no new waves will be born, but the death rate will continue unabated until the last wave has disappeared.

The life span of a sound wave (or in other words, the period for which sound persists after emission has ceased), is controlled by the power output of the source, by the average distance between reflections, and by the fractional part of the energy absorbed on each reflection—or, as the engineer says, the "average co-efficient of absorption" of the walls or other obstructions in the room.

With fixed room conditions, therefore, this period varies only with power output, and when the intensity produced is a million times the minimum audible intensity, the period is called the reverberation time for that particular room. This term was first used by W. C. Sabine, and the value of intensity selected was tht obtained from organ pipes used for most of his work.

Reverberation time, however, marks merely a period during which the sound drops a definite amount in intensity. No information whatever is given by it as to the relation of sound intensity to time within the period. Rooms in which sound decayed in quite different manners might yield the same reverberation time. Although, on that account, reverberation time is easily measured, it is of little use.

Denver L. U. Election

J. E. Davis was elected president of Denver, Colorado, Local Union 230 at the last meeting. Other officers named for the coming year are: James Dooley, vice-president; Larry Campbell, recording secretary; E. A. Roegner, financial secretary; and George Thomas, business manager.

missing numbers.

International PROJECTIONIST

Edited by James J. Finn

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March, 1932

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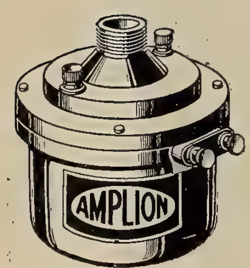

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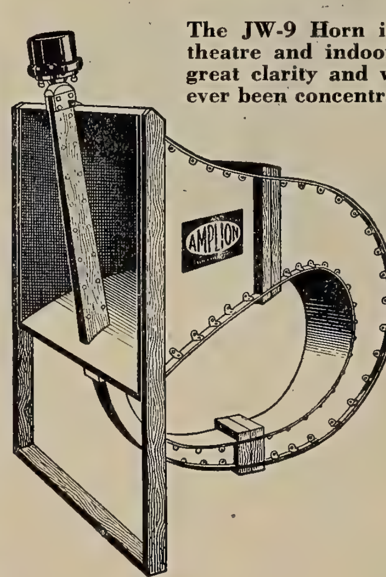

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International PROJECTIONIST

Edited by James J. Finn

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International Projectionist is not responsible for personal opinions appearing in signed articles in its columns.

MONTHLY CHAT

BY withholding the announcement of its new recording and reproducing system Western Electric Company has remained steadfast to that unwritten rule of the company which is to perfect a device first and ballyhoo it afterward. Of course, our reputation as a forecaster suffered as a result of this decision on the part of W. E., as we had promised our readers full details of the new system in this issue.

NOW that the matter of uniform aperture procedure for both production and projection has been settled, emphasis should be placed on the necessity for strict adherence to the recommended aperture height of .600". Variance from this figure simply means that all the hard work done on this project will have gone for naught—for with the studios utilizing the full area for composition, the choice of adhering or not to the full height lies not with the projectionist. Just another usurpation of our powers over the cinema welfare of the matinee idols.

HOW many projectionists, taking their cues from the item relative to lower insurance rates which appeared in our February issue, have asked their insurance companies for a reduction in rates? The facts with which to buttress your argument were included in this item; and if you haven't yet taken advantage of this situation, do so promptly. . . . Don't mention it. Just another one of our little services.

SAMUEL BAGNO'S article, "Comparative Worth of D.C. Power Sources," which appeared last month proved definitely how little time most manufacturers of power supply devices spend at their plants. The number of "out-of-towns" which were received in reply to our requests for comment on this article surpassed all previous high marks. On occasion we find it convenient to be "out of town," but never when something is said, or written, or done to reflect unfavorably upon our product. And particularly happy are we to be in town when an offer to run our comment verbatim is made.

The inevitable ray of sunshine makes its appearance in this case: we are overflowing with happiness to be able to report that the proper parties were available at Roth Brothers & Co., 1,400 West Adams St., Chicago, and at Electric Specialty Co., Stamford, Conn.—both houses being the manufacturers of very fine products for projection room use.

INTERNATIONAL PROJECTIONIST

VOLUME II NUMBER 1

MARCH 1932

FUNDAMENTALS OF TESTING ELECTRIC CIRCUITS

A. C. Schroeder

MEMBER I. A. LOCAL UNION 150, LOS ANGELES, CALIF.

III

IN the last article we discussed the testing of a line and a fuse block very thoroughly, using a 110-volt lamp. If the line had been 550 instead of 110, it would have burned out the lamp the first time it was put across the circuit.

Had we used a 12-volt lamp on the 110-volt line, the result would have been the same. Using a 110-volt lamp on a 12-volt line would give no results, the voltage not being high enough to force sufficient current through the light to give an indication. When testing a 110-volt circuit with a 220-volt lamp the result is that the lamp glows dimly, but in most cases this is O.K. if the fact that we are using a lamp designed to be worked on a higher voltage is kept in mind.

We now realize that testing apparatus must be suitable to the circuit to be tested: different circuits require different apparatus. Often the testing device can be adapted to the circuit. An example of this is the test lamp having two sockets and two 110-volt lamps. The lamps are in series and form the equivalent of a 220-volt lamp.

Figure 1 shows such a tester. With it we can test both 110- and 220-volt circuits. Naturally, the lamps will not burn to full brilliancy on 110 volts. Sometimes a lead is brought out between the lamps so that it can be used with one of the outside leads when testing 110 volts. Only one lamp lights when they are used in this manner, and it burns brightly only if the voltage is normal.

Other Methods

Let us leave the test lamp for the time being and take up other methods of testing. The voltmeter as a test instrument has certain advantages and certain disadvantages. The chief disadvantages are the delicacy of a good meter and the cost if it is ruined. Replacing a burned-out test lamp is a matter of thirty or forty cents. The cost of the average meter will run from five dollars up. It is true that meters can be obtained for about a dollar, and sometimes less, but these are not used a great deal and then only for testing battery voltages.

A DC meter can be used only on DC. Some DC meters are now supplied with a copper-oxide rectifier, allowing them to be used on AC, but it is then considered to be an AC meter. Most of the AC meters can be used on DC as well as on AC, although they usually are not as accurate in such a case as the DC meter. On some types of DC circuits the AC meter cannot be used at all, even though the same meter can be used on other DC circuits.

Some of the advantages in using a voltmeter are that it *usually* shows nearly the exact voltage present. On low resistance circuits—such as power lines, battery circuits, etc.—any ordinary meter will show the voltage; but when testing high resistance circuits found in amplifier and power supply devices the ordinary meter will show only a fraction of the voltage that is *normally* present. The reason for this is that all meters require a flow of current through the instrument in order to give an indication; they are devices that consume power, and that power must be supplied by the circuit under test.

If the circuit we are testing has a comparatively great amount of resistance, there will be a large drop in voltage across it due to the current drawn by the meter. Usually there already is a current flowing: it may be the current taken by the plate of an amplifier tube. The purpose of the test might be to determine the voltage at the plate of the tube under working conditions. The current taken by the plate causes a drop in voltage across the resistance, and when the addi-

Figure 1

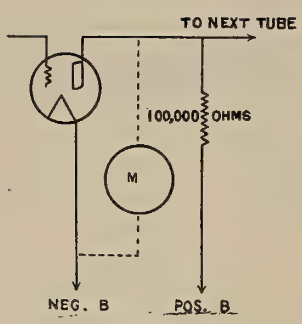


Figure 2

tional current taken by the meter flows through the circuit, it may upset the normal conditions to such an extent that a reading on the meter may be next to meaningless. When it is only desired to know if plate voltage is present at the tube, this indication is sufficient.

The Circuit

The full lines in Figure 2 show the plate circuit of a tube, and the dotted lines show how the voltmeter is hooked-in. Starting at the arrow marked "Pos. B," we see that the current must go up through the 100,000-ohm resistance, over to the plate of the tube, through the tube and down the wire to the arrow marked "Neg. B"; from here the circuit is completed through whatever the source of B potential happens to be. Notice that the tube and the resistance are in series: all current flowing through the resistance must also flow through the tube. The lead going to the next tube does not enter into this, since it does not carry DC. A condenser is placed in the line to isolate this circuit from the following tube.

Now consider the meter. It is connected from the plate to the filament of the tube, and the meter and the tube are connected in parallel. Any current drawn by the meter must be an additional current coming through the resistance. In order to see why certain meters can be used and others cannot, let us analyze the conditions of this hook-up before and after the meter is connected.

Resistance and Voltage

First we re-draw Figure 2 so as to get it into a shape in which it will be easier to visualize what is happening. This new form is shown in Figure 3. Electrically it is the same as Figure 2, with the exception that the meter has been left out. The plate to filament resistance of the tube is represented by a zig-zag line marked "10,000 ohms." This is the value that some types of tubes used in this position have, although it may be varied by changing the voltages applied to the tube. When the grid of the tube is not excited by a signal, the tube acts the same as would a simple resistance, if placed in that position.

The total resistance from "Pos. B" to "Neg. B" is 100,000 plus 10,000, or 110,000 ohms. The voltage from "Pos. B" to "Neg. B" is 130. Applying ohms-law we find that there will be a current of .00118 amps., which is equal to 1.18 mils. A sensitive milliammeter would show this and make it unnecessary to work out the mathematics. We are now ready to find the drop in voltage across the tube. Multiplying the plate resistance by the current (10,000 times .00118), gives us 11.8, the effective voltage at the plate. This is the voltage a meter would show *if we could get one that did not draw any current.*

Figure 4 shows the condition of the circuit after the meter has been added. The resistance marked 3,000 ohms represents the meter. One type of meter used a great deal in projection rooms has a resistance quite close to that value. Comparing Figure 4 with Figure 2 we see that they are the same, excepting that we have used the symbol for resistance instead of drawing in the tube and the meter.

Current coming from "Pos. B" flows through the 100,000 resistance. From the point *A* there are two paths that it can take: either through the 10,000-ohm resistance, which is the plate to filament resistance of the tube, or through the 3,000-ohm resistance, which is the meter —the two resistances being in parallel.

Calculating Resistance

To find the total resistance in the circuit we must first see what the resistance is from *A* to *B*. This is found by dividing the product of the resistances by their sum. 3,000 times 10,000 equals 30,000,000. The sum of these resistances equals 13,000. Dividing 30,000,000 by 13,000 gives us 2,308, or 2,300 ohms in round numbers. Using ohms-law again, we have the voltage, 130, divided by the total resistance, 102,300, giving us .00127, the answer being in amperes. Multiplying by 1,000 changes it to milliamperes, equaling 1.27 mils. (Mils. is used in place of the longer word, milliamperes.)

Knowing the value of the current we can find the voltage at the plate. Multiplying the total resistance from *A* to *B* by the total current flowing, 2,300 times .00127, which equals 2.9 plus, we get

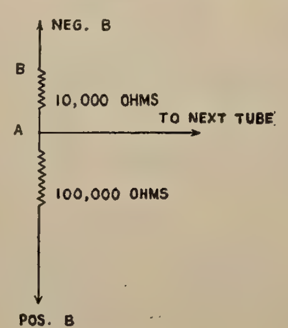


Figure 3

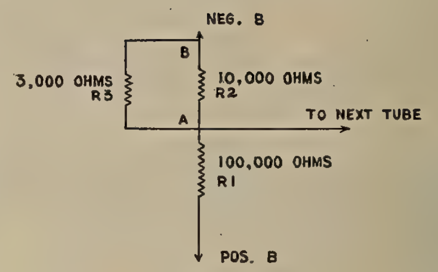


Figure 4

the voltage at the plate *when the meter is hooked on as shown.*

Bear in mind that the meter does not show a wrong value of voltage. It indicates the actual voltage present when it is connected across the circuit; but when it is hooked-in *it changes the voltage*, the conditions not being the same as they were before the meter was used.

Notice that the resistance in ohms was multiplied by the current in amperes, which is .00127. Had the figure 1.27 been used, which is the number of mils, the result would have been incorrect. Ohms-law states that the resistance multiplied by the current equals the voltage —but the units to be used are the ohm, ampere, and the volt. If the current is expressed in mils., it must first be changed to amperes by dividing it by 1,000. Of course, the same thing is accomplished if mils. are used and the answer then divided by 1,000. However, if we are not familiar with this sort of work, confusion might result, and it will probably be better if we use the first method, changing mils. to amperes and *then* multiplying.

By using mathematics we found that the voltage at the plate of the tube is very close to 11.8. We then found that the voltage dropped to about 2.9 when the meter was applied. Needless to say, a meter that shows a reading of 2.9 when the voltage in the circuit is normally 11.8 is not of very much use. It shows the circuit to be continuous, but that is all. An open grid circuit, a defective tube, shorted condensers or resistances may often cause the voltage at the plate to actually be 2 or 3 volts, but the meter we have under discussion will not give an indication that can be depended upon to show such conditions.

Meter Characteristics

This meter has a resistance about one-third that of the tube. If we used a meter having a very much higher resistance than the tube, it will not affect the result nearly as much as the low resistance meter. Meters used for this sort of work are very sensitive and have a resistance of 1,000 ohms per volt. If the meter has a full-scale reading of 100 volts, its resistance will be 100,000 ohms. Let us hook such a meter into the circuit shown in Figure 4 and then see

Table A

	Without meter	With 3,000 ohm meter	With 100,000 ohm meter
Total Resistance From A to B	10,000 ohms	2,300 ohms	9,090 ohms
Total Current	1.18 mils	1.27 mils	1.19 mils
Voltage at Plate	11.8 volts	2.9 volts	10.8 volts

what are the results. Figure 4 can still represent our hook-up, if we keep the fact in mind that *R*3 is now 100,000 ohms.

Finding the total resistance from *A* to *B*, the product of *R*2 and *R*3 is 1,000,000,000. Their sum is 110,000. Dividing the former by the latter gives us a fraction more than 9,090.9 as the number of ohms when these two resistances are connected in parallel. We drop the decimal and use the number 9,090. As far as practical results are concerned this could be changed to 9,000, and this is what ordinarily would be done, as the result would be sufficiently close. This would also account for small discrepancies in results at times, but these may be overlooked.

The entire resistance in the circuit from "Pos. B" to "Neg. B" is now 100,000 plus 9,090, or 109,090 ohms. Dividing the voltage, 130, by this figure results in .00119, or 1.19 mils. 9,090 times .00119 equals 10.8, the voltage at the plate when we use the high resistance meter. The voltage with no meter in the circuit was 11.8, a difference of 1 volt, or about 9 per cent, which is close enough.

We make up a table using these values and we see at a glance what takes place when the different meters are used (Table A).

Notice the small differences in values in columns 1 and 3, as contrasted with the comparatively large differences in columns 1 and 2 and also in columns 2 and 3.

In testing for voltage at the plate of a tube in a transformer-coupled amplifier the high resistance meter would read very nearly the normal voltage, since the resistance of the transformer primary is only a few thousand ohms and often it is less than one thousand. Under such conditions the plate voltage will be about 118 when the voltage of the B-supply is 130. Our high resistance meter *would* read 116, but it only has a scale running up to 100 volts, so we must use a meter having a range of 250 or 500 volts. Either of these meters will read even closer to 118 volts than the meter with the 100-volt scale. Notice that the meter reading will be less than 2 per cent off.

The foregoing shows how important it is to use the proper type of testing device. The low resistance meter and the test lamp were O.K. for the line we were testing in Article II, but they are altogether inadequate for testing high resistance circuits. The low resistance meter gave a small indication at the plate but the test lamp would give no indication whatever. The high resistance meters are O.K. for testing low resistance circuits, providing we use one having the proper range. The 100-volt meter would not do to test a 110-volt line, nor would it do for testing a 2-volt line. If a meter is wanted only for testing low resistance circuits it would be needless expense to purchase a meter of the more sensitive type.

Relative Foot-Candles

IT is possible to analyze precisely the several fundamental characteristics of vision and, from these data, to determine the relative foot-candles required for equality of visual difficulty in various situations. When this method of analysis is applied to the average lighting installation the inadequacy of the lighting in many instances is conspicuous.

There are many factors involved in seeing, but the following are fundamental: Size of object expressed in minutes of visual angle subtended at the eye by the smallest detail to be seen; contrast between object and its background—definable as the ratio of brightness difference (between object and background), to the brightness of the background and designated as per cent contrast; brightness level resulting from foot-candles and reflection factor; time of exposure of retina to the image of the object.

The relationship between these four factors has been quantitatively determined, thus enabling the lighting specialist to make accurate comparisons between practical lighting situations.

A few examples are presented herewith to illustrate the application of this analysis to lighting problems. Several situations differing in size, contrast and time allowed for seeing were assumed and the foot-candles required in each case were obtained from the relationship of the four fundamental factors.

The foot-candles given (table), represent absolute values for threshold seeing, at which the object is seen with 50 per cent certainty. Such visibility is, of course, inadequate for the work-world but it is a condition at which exact measurement on seeing is possible. In lighting practice, the foot-candles of the table become relative foot-candles and form the basis for a scientific distribution of light to the various visual tasks in proportion to their difficulty.—M. LUCKIESH in *Electrical World*, January 9, 1932.

Different Situations—Equal Visual Difficulty

Size of Object (in Minutes in Visual Angle)	Contrast with Background (Per Cent)	Time Allowed for Seeing (Seconds)	Foot-Candles for Threshold Seeing
0.8	50	0.17	100
1.5	50	0.17	1
1.4	10	0.17	100
3.0	10	0.30	1
10.0	2	0.30	00

Special Sound Reinforcing Equipment by ERPI

An interesting example of how special equipment for sound amplification and transmission can be arranged in connection with talking picture equipment was offered recently when the Audubon Theatr, New York, was confronted with the necessity of reinforcing a crooning specialty act to satisfactorily penetrate the entire auditorium. The problem, referred to the Special Projects Department of ERPI was solved by the installation of a special P.A. attachment consisting of two microphones, a microphone control panel and two loud speakers to work in conjunction with the theatre's sound system.

The Hook-Up

The microphones were equipped with outlets and plugging facilities to allow placement at any desired stage location. The control panel was put in the projection room near one of the spot light positions. It provided means of controlling the amplification and of associating either of the microphones with the main system. The horns were located so as to project the artist's voice beyond normal range and so that patrons throughout the house could hear equally well. With this equipment the theatre was able to stage a take-off of a radio broadcast specialty number.

Such special jobs can be executed at any time in connection with existing W. E. Sound System installations.

UNIFORM APERTURE PRACTICE SET BY ACADEMY

THE major motion picture studios and theatre circuits have adopted a uniform practice governing the image area on 35 mm. film for photography and projection which will result in an important improvement in photographic quality, according to an announcement by the Academy of Motion Picture Arts and Sciences. This completes one of the final equipment changes in the transition from silent to sound pictures.

Companies which are putting the Academy specifications into effect for forthcoming productions include: Columbia, Educational-Metropolitan, Fox, Hal Roach, Metro - Goldwyn - Mayer, Paramount, RKO-Radio, United Artists, Universal, and Warner Brothers-First National.

Studio camera apertures have been adjusted to photograph an image .868″ by .631″ on the negative, with center line .7445″ from the control edge, to be correlated to theatre projector apertures .600″ x .825″, with center line .7380″ from the control edge, the difference being necessary allowances for shrinkage and mechanical tolerances.

Instructions Ready Soon

Specifications and instructions for adapting apertures, lenses, and screen masks will be distributed to the projectionists of all theatres in the United States during the next few weeks.

The uniform practice will apply to all types of motion pictures made for exhibition in theatres and will supplant the different image areas used for disc prints, sound track prints and silent versions. It is expected to settle difficulties which have vexed studios and theatres since the introduction of talking pictures and to end the wide variation in projector apertures for which studios have had to provide in photography.

Principle advantages of the uniform practice will be that when equipment is adjusted to the specifications, movable lens mounts, sliding aperture plates and other adaptive devices may be dispensed with in theatres; the likelihood of cutting off heads and feet of characters on the screen will be reduced; and both studio and theatres will be assured that the full height of the photographed image will be transferred to the screen. Increased efficiency in photographic operations on the studio set will also be made possible through the matting out of wasted film area which it has been necessary to photograph to accommodate variation in theatre apertures.

Approximate 3 x 4 Size

Projection of the picture image by the new specifications will result in screen proportions of approximately three by four in theatres with medium projection angles. The screen will appear slightly

New Aperture Specifications

The following specifications are recommended for studio and theatre uniform aperture practice to go into effect for new productions now being photographed:

Projection Apertures

Upon receiving product with the new frame size, theatres should adjust their projector apertures to dimensions of .600″ x .825″, the center line to be .738″ from the guiding edge of the film. Other dimensions are shown in Figure 2.

In no case should any theatre reduce the height of this aperture. Screen masks should be adjusted for a minimum overlap on the screen, as adequate tolerances for shrinkage and weave have been made in the specified aperture.

Photographic Image

Adaptation of camera and other equipment to an aperture of .631″ x .868″, having its center line .7445″ from the guiding edge of the film. Other dimensions are to be as indicated in Figure 1. When the area reserved for the sound track is not used it is to

Fig. 1—Academy recommended camera aperture

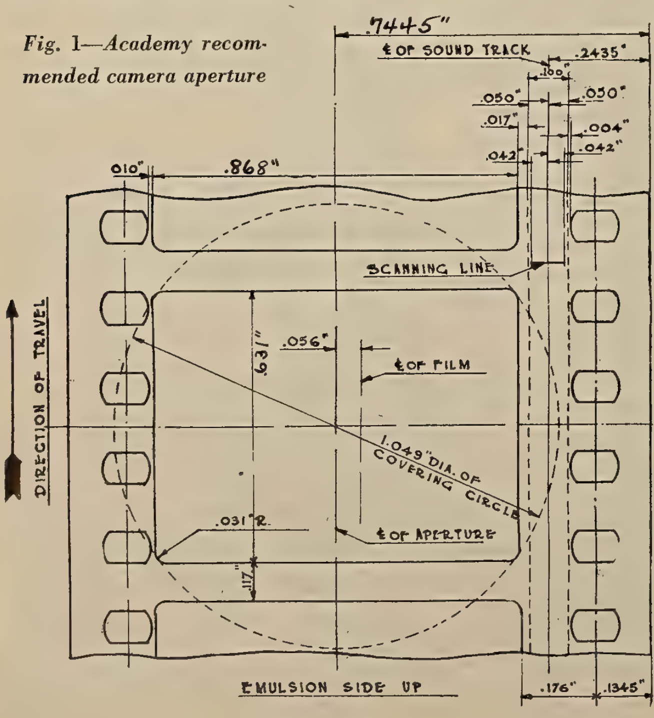
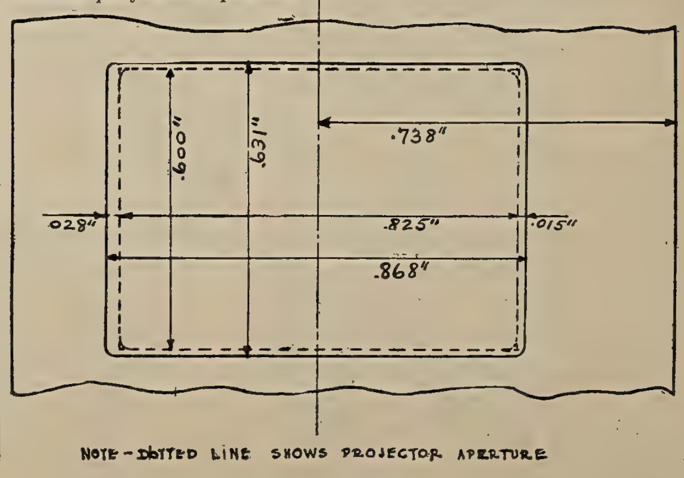


Fig. 2—Academy recommended projection aperture



wider when the picture is projected from a low angle and slightly taller in those theatres with steep projection angles.

The present agreement among the companies to adopt a uniform practice has developed from research, surveys and conferences between representatives of studios and theatres during the past ten months, under the sponsorship of the Academy Producers-Technicians Committee. For the past two years studios have been composing sound pictures according to temporary recommendations issued by the Academy until theatre projection conditions should become sufficiently stabilized to warrant establishment of more permanent specifications.

The revised specifications represent the best adjustment between photographic and projection requirements upon which it has been possible to secure general agreement between the studios and theatre circuits.

Previous Practice

The project originally started with the studios in an effort to get away from multiple composition and photography of nearly a hundred mil. wasted area on the film. Multiple composition with lines on the camera ground glass have been expensive and inconvenient but necessary for the past two years for reasons given in detail in previous Academy Reports.

As the percentage of disc release has been growing less, the Academy was authorized some months ago to investigate the problem and improve the situation. It was found that the only solution would be to correlate camera and projector apertures. A canvass was taken of studios to see if a majority favored such a step. Tentative specifications and the plan of procedure were presented in Report No. 24 dated October 10, 1931. The studios unanimously approved and the Academy took the next step, which was to present the proposal to the theatre circuit and release organizations. The tentative specifications were on the basis of the largest 3 x 4 proportion in the camera but did not consider any correction for angle of projection.

During consideration of the aperture proposal the theatre circuit representatives reached a definite basis for correction for angle of projection. This basis was eighteen degrees. To get a three by four picture at this angle a projection aperture of .590″ x .825″ was determined upon.

Area vs. Proportion

A series of conferences was held by studio technicians in Hollywood and theatre technicians in New York, and views were exchanged. At the request of the studios the theatres made a concession in proportion for the sake of area and agreed to an alternative proposal made

A Valuable Technical Accomplishment

FINAL action by the Academy on camera and projector aperture dimensions, as reported in the accompanying article, would seem to write "finis" to this highly important and, heretofore, very troublesome matter of screen area and proportion. The Academy has approved a camera aperture adjusted to photograph an image .868″ x .631″ on the negative to be correlated to a theatre projection aperture of .600″ x .825″, which will result in a screen image of approximately 3 x 4 proportion in those theatres having a projection angle of 18°, which has been fixed as "average."

Several questions stemming out of these recommendations remain to be answered. First there is the question as to whether 18° really is "average," what with many Class A theatres running up to 25° and even beyond in some instances. The answer is that investigation has definitely proven that 18°, while not wholly satisfactory to those theatres with steep projection angles, is the *best average figure for all theatres.* Any consideration of standards must provide for the field as a whole, thus common sense dictates the answer to this question.

The next most important question has to do with the necessity for reconciling the Academy figures with the .590″ x .825″ dimensions as formally approved by the S.M.P.E. through its Standards Committee. While no announcement bearing on this point has yet been made by the S.M.P.E., INTERNATIONAL PROJECTIONIST is reliably informed that the Standards Committee will give its approval to the Academy recommendation of .600″.

In any event, the difference is so small as to be negligible. With a 16-foot screen picture the difference amounts to slightly more than 3 inches, and it is evident that this will not be noticeable. The S.M.P.E. figures will give exactly a 3 x 4 proportional screen image on the basis of an 18° projection angle. The Academy figure of .600″ appears to be eminently fair, and particularly so when it is recalled that it withdrew its first request for .615″ when it became apparent that Class A theatres would be penalized by its adoption. In those houses having a projection angle of 25° or thereabouts it will be necessary to still further reduce the aperture to about .580″.

One thing established by the investigation incident to this uniform aperture activity is the fact that a majority of the Class A theatres, which are among the finest in the field and are the most important money producers, have steep projection angles. So much for all this talk about projection-on-the-level. Builders still continue to think of projection, the heart of the theatre, after everything else has been decided upon.

It will be noted in the accompanying drawings (Figs. 1 and 2), that the aperture is round-cornered, a type preferred by many. Provision has been made, however, for filing of the aperture plate so that a square aperture and a resultant square screen picture may be had.

Now that the dimensions have been decided upon, the next important step is the maintenance of the practice in the theatre so that the studios may safely utilize the full area available for dramatic action. Arrangements are now being made to supply all projectionists with full particulars on the new aperture, so that any possibility of error may be avoided. Pictures made on the basis of the new dimensions are already in work; but no theatre changes should be made until official notification is received from the exchanges.

The establishment of this new aperture practice fully demonstrated the wisdom of furthering a closer relationship between the studio and theatre technicians with a view to effecting greater improvements in both branches. It was inevitable that each branch should seek that which was of greater advantage to itself, and the differences of opinion which developed were to be expected. In this, as in all things, a willingness to compromise brought results.

Many men worked many hours on this uniform aperture job, and a lack of space prevents our listing the names of all those who contributed to the task. Suffice it to say that both the production and exhibition branches of the industry benefited through superb representation by men who proved themselves commendably jealous of high quality work in their respective fields.

JAMES J. FINN.

PROJECTION TABLE:

Showing Size of Screen Images at Different Distances with Lenses of Different Focal Length

Size of Picture Aperture: 0.825″ x 0.600″

E.F. in.	40 ft.	50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	120 ft.	130 ft.	140 ft.	150 ft.	160 ft.	170 ft.	180 ft.	190 ft.	200 ft.
2.00"	16.4 11.9	20.5 14.9	24.6 17.9	28.8 20.9	32.9 23.9	37.0 26.9	41.1 29.9	45.3 32.9									
2.25"	14.6 10.6	18.3 13.3	22.0 16.0	25.6 18.6	29.2 21.2	32.9 23.9	36.6 26.6	40.2 29.2	43.9 31.9	47.5 34.6							
2.50"	13.1 9.6	16.4 11.9	19.7 14.4	23.0 16.8	26.3 19.1	29.6 21.5	32.9 23.9	36.2 26.3	39.5 28.7	42.8 31.1	45.6 33.5						
2.75"	12.0 8.7	15.0 10.9	17.9 13.0	20.9 15.2	23.9 17.4	26.9 19.6	29.9 21.8	32.9 23.9	36.0 26.1	39.0 28.3	42.0 30.5	45.0 32.7	48.1 34.9				
3.00"	10.9 8.0	13.7 10.0	16.4 11.9	19.2 14.0	22.0 16.0	24.6 17.9	27.4 20.0	30.2 22.0	32.9 23.9	35.7 25.9	38.4 27.9	41.1 29.9	43.9 31.9	46.7 34.0			
3.25"	10.1 7.3	12.7 9.2	15.2 11.0	17.7 12.8	20.2 14.7	22.8 16.6	25.3 18.4	27.8 20.3	30.4 22.1	32.9 23.9	35.5 25.8	38.0 27.6	40.5 29.5	43.0 31.3	45.6 33.1		
3.50"	9.4 6.8	11.7 8.5	14.1 10.3	16.4 11.9	18.8 13.7	21.1 15.4	23.5 17.1	25.9 18.8	28.3 20.5	30.5 22.2	32.9 23.9	35.2 25.5	37.5 27.3	39.9 29.0	42.3 30.8	44.7 32.5	47.0 34.2
3.75"		10.9 7.9	13.1 9.6	15.3 11.1	17.5 12.8	19.7 14.4	22.0 16.0	24.0 17.6	26.3 19.1	28.6 20.7	30.7 22.3	32.9 23.9	35.2 25.6	37.3 27.2	39.5 28.8	41.7 30.3	43.9 31.9
4.00"		10.2 7.4	12.3 8.9	14.3 10.4	16.4 11.9	18.5 13.4	20.5 14.9	22.6 16.4	24.6 17.9	26.7 19.4	28.8 20.9	30.8 22.4	32.9 23.9	35.0 25.4	37.0 26.9	39.1 28.4	41.1 29.9
4.25"		9.7 7.1	11.7 8.5	13.5 9.8	15.5 11.2	17.4 12.7	19.3 14.0	21.2 15.4	23.2 16.8	25.2 18.3	27.1 19.7	29.1 21.1	30.9 22.5	32.9 23.9	34.9 25.3	36.8 26.8	38.8 28.2
4.50"			10.9 8.0	12.8 9.3	14.6 10.6	16.4 11.9	18.3 13.3	20.1 14.6	22.0 16.0	23.7 17.2	25.6 18.6	27.4 20.0	29.2 21.2	31.0 22.6	32.9 23.9	34.8 25.3	36.6 26.6
4.75"			10.4 7.6	12.2 8.9	13.9 10.1	15.7 11.4	17.3 12.6	19.0 13.0	20.7 15.1	22.5 16.4	24.2 17.6	26.0 18.9	27.6 20.1	29.4 21.4	31.1 22.6	32.9 23.9	34.7 25.2
5.00"				11.6 8.4	13.1 9.6	14.9 10.8	16.4 11.9	18.1 13.2	19.7 14.4	21.4 15.6	23.0 16.8	24.6 17.9	26.3 19.1	27.9 20.3	29.6 21.5	31.3 22.8	32.9 23.9
5.25"				10.9 7.9	12.5 9.1	14.1 10.3	15.7 11.4	17.2 12.5	18.8 13.7	20.3 14.8	21.8 15.9	23.5 17.1	25.1 18.3	26.7 19.4	28.3 20.5	29.8 21.7	31.3 22.8
5.50"				10.5 7.6	12.0 8.7	13.5 9.8	15.0 10.9	16.4 11.9	17.9 13.0	19.4 14.1	20.9 15.2	22.4 16.3	23.9 17.4	25.4 18.5	26.9 19.6	28.4 20.6	29.9 21.8
5.75"					11.3 8.3	12.8 9.3	14.2 10.3	15.7 11.4	17.1 12.4	18.6 13.5	20.0 14.5	21.4 15.6	22.9 16.6	24.3 17.7	25.8 18.7	27.2 19.8	28.6 20.8
6.00"					10.9 8.0	12.3 8.9	13.7 10.0	15.1 10.9	16.4 11.9	17.8 13.0	19.2 14.0	20.5 14.9	22.0 16.0	23.3 17.0	24.6 17.9	26.0 18.9	27.4 20.0
6.25"					10.5 7.7	11.9 8.6	13.1 9.5	14.3 10.4	15.9 11.4	17.0 12.4	18.4 13.3	19.7 14.3	21.0 15.3	22.3 16.2	23.6 17.2	25.0 18.1	26.3 19.1
6.50"						11.4 8.3	12.7 9.2	13.9 10.1	15.2 11.0	16.4 11.9	17.7 12.8	18.9 13.7	20.2 14.7	21.5 15.6	22.8 16.6	24.0 17.5	25.3 18.4
6.75"						10.9 7.9	12.2 8.8	13.4 9.8	14.6 10.6	15.9 11.6	17.0 12.4	18.3 13.3	19.5 14.2	20.7 15.1	22.0 16.0	23.2 16.9	24.4 17.8
7.00"						10.5 7.6	11.7 8.5	12.9 9.4	14.1 10.3	15.3 11.1	16.4 11.9	17.5 12.8	18.8 13.7	19.9 14.5	21.1 15.4	22.3 16.2	23.5 17.1
7.50"							10.9 7.9	12.0 8.7	13.1 9.6	14.2 10.3	15.3 11.1	16.4 11.9	17.5 12.8	18.7 13.6	19.7 14.4	20.8 15.2	22.0 16.0
8.00"							10.2 7.4	11.2 8.2	12.3 8.9	13.3 9.7	14.3 10.4	15.4 11.2	16.4 11.9	17.4 12.7	18.5 13.4	19.5 14.2	20.5 14.9
8.50"								10.6 7.6	11.7 8.5	12.6 9.1	13.5 9.8	14.5 10.5	15.5 11.2	16.4 11.9	17.4 12.7	18.4 13.4	19.3 14.0
9.00"									11.0 8.0	11.8 8.6	12.8 9.3	13.7 10.0	14.6 10.6	15.5 11.3	16.4 11.9	17.3 12.6	18.3 13.3
E.F. in.	40 ft.	50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	120 ft.	130 ft.	140 ft.	150 ft.	160 ft.	170 ft.	180 ft.	190 ft.	200 ft.

SIZES GIVEN ARE TO THE NEAREST TENTH OF A FOOT

This table supersedes all previous screen image tables

[Courtesy, Bausch & Lomb Optical Co.]

Important!

It is of the utmost importance that projectionists and theatre managers maintain the full aperture height of .600". As soon as the height is cut down the essential substance photographed will be lost and the situation becomes as bad as, if not actually worse than, before, as studios will be composing for the full area. This point is outstanding in the work of introducing and maintaining the new uniform aperture.

by the studios. This proposal was to establish a theatre aperture of .600" x .825". While some individual theatre technicians are still urging the .590" height, the executives have agreed to the .600" x .825" and will undertake to enforce it in their theatres and bring about a uniform aperture height for the first time since the introduction of sound pictures.

Following the same line of reasoning as for the original tentative specifications, the Academy subcommittee recommended that the studios photograph new productions according to the accompanying specifications. The image as photographed is to be .631" high by .868" wide with the expectation that after shrinkages and mechanical variations have taken place the image will be just the right size for satisfactory projection through the theatre aperture.

A Break-Down of Service Dollar, ERPI's Reply to Critics

TROUBLE-PREVENTING inspections, appointment and emergency calls, replacement part inventories in key cities, free replacements, repairs and improvements, general administrative expenses and protection against fire loss are the things that the service dollar pays for, C. W. Bunn, General Sales Manager of Electrical Research Products, stated recently in outlining how service charges have been brought to a minimum consistent with the maintenance of high quality of reproduction and continuous, dependable operation.

Only 4.3 cents of every dollar goes to administrative and engineering expenses.

The regular inspection service takes 54.1 cents, and emergency and appointment calls account for 13 cents. The former comprise the regular trouble-preventing inspections made by a field force of 600 who travel 5,720,000 miles annually among 5,500 Western Electric-equipped theatres. Appointment and emergency calls are additional visits, the former to discuss problems of equipment maintenance and operation by appointment, and the latter in response to an immediate emergency.

Inspection vs. Service

Experience gained in contact with 8,000 theatres has demonstrated, Mr. Bunn stated, that a definite relationship exists between the number of inspection and emergency calls. The latter at present average one per theatre every 18 months. Any attempt to economize by cutting down the inspection calls would automatically increase service costs by a resulting larger number of more costly emergency calls, Mr. Bunn explained. Even more important, he pointed out, would be the menace of interrupted and cancelled shows resulting from lack of sufficient inspections.

Where the Money Goes

Thirteen cents out of every dollar goes for the maintenance of $750,000 replacement part inventories in 35 key cities and of 173 other service points. These assure maximum freedom from program interruption because of the ability to speedily replace parts in an emergency.

Out of every service dollar 4.6 cents goes for free replacements, repairs and improvements made by Electrical Research Products without charge to exhibitors. This activity was initiated last year without any increase in service charges and is estimated to have saved exhibitors $750,000 in one year. It also finances the Inquiry Bureau in New York, organized in 1931 to co-operate with exhibitors in supplying adequate information regarding equipment operation and maintenance.

The final 11 cents out of the dollar goes for protection against fire loss. It assures the immediate replacement of any equipment or parts damaged by fire without a lost moment for technical formalities or the signing of papers.

Summing up the itemization of the service dollar, Mr. Bunn said:

"We have reduced charges to the absolute minimum consistent with satisfactory reproduction and the greatest possible promise of continuous, dependable performance. In our estimation these are the foremost box office considerations. Whenever we have been able to effect economies without jeopardizing them, we have promptly passed on to the exhibitors the savings in the form of reductions in service charges.

"The best assurance that we have acted wisely in placing quality reproduction and steady performance first lies in the fact that only 5 per cent of the Western Electric-equipped theatres are closed today as compared with 50 per cent dark houses among theatres with competitive types of equipment. We are unable to escape the conclusion that the quality of sound and its steady dependability of operation have been big factors in enabling Western Electric-equipped theatres to hold patronage and make such a favorable record, by comparison with others, under present conditions. We feel that every cent we have asked of exhibitors in service charges has been justified by actual box office considerations to their advantage; and the record of closed theatres would seem to support our contention."

TELEVISION 'OVERSOLD' TO PUBLIC, SAYS R.M.A.

MANY problems remain to be solved before television can become a satisfactory means of home entertainment, says the Radio Manufacturers Association, in a statement on the present status of this broadcasting development.

Declaring that television and its prospects have been very much oversold to the public, and that it is still a question how it will be possible to obtain sufficient revenue, either from advertisers or by taxing the public, to meet the added cost of staging television programs, the association cites the following as the most important technical obstacles still to be overcome:

Technical Problems

1. Greater detail should be obtained in received picture.
2. Television transmission pick-up equipment should be portable and as easily used as present-day sound picture pick-up equipment.
3. Transmitting systems must be evolved which will have a satisfactory and reliable service range.
4. Receivers as simple in operation as our present radio receivers must be designed and built at a reasonable cost.
5. Quiet and satisfactorily illuminated picture equipment for the home must be designed and built at a reasonable cost.

Bob Gray has been elected president of Local Union 546 (Lowell, Mass.) for the tenth consecutive time. Other officers are Sidney E. Bow, re-elected business representative; Maurice Cooper, treasurer; and Sidney Barton, secretary.

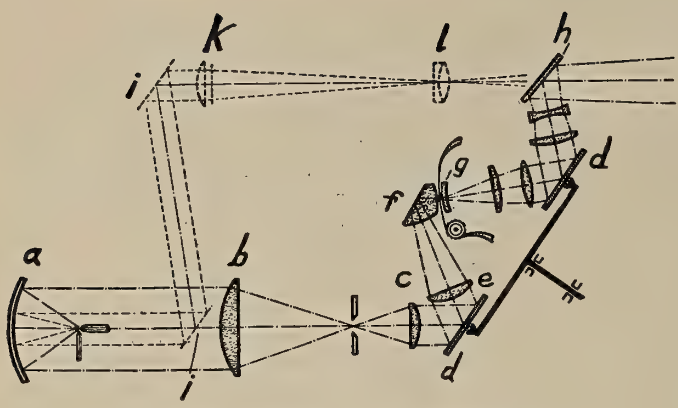
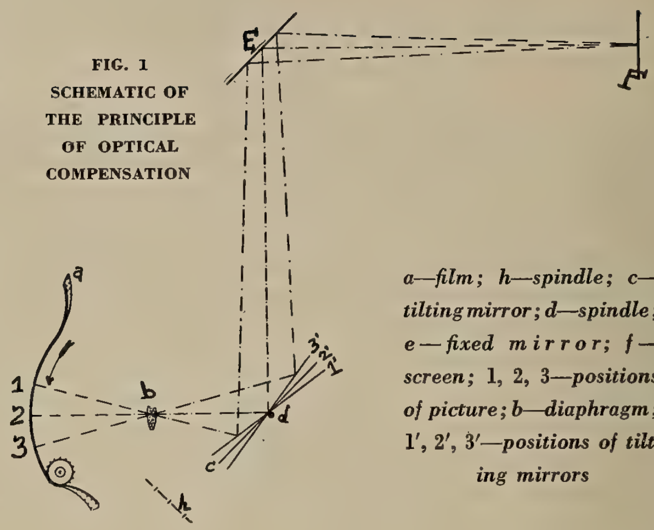


FIG. 2. BEAM DIRECTION IN NEW PROJECTOR

a—parabolic mirror; b, c, e—lenses; d—tilting mirror; f—prism; g—film; h—adjusting mirror; i—diapositive (slide), mirror; i, k, l—projection lenses

FIG. 1 SCHEMATIC OF THE PRINCIPLE OF OPTICAL COMPENSATION



a—film; h—spindle; c—tilting mirror; d—spindle; e—fixed mirror; f—screen; 1, 2, 3*—positions of picture; b—diaphragm;* 1′, 2′, 3′*—positions of tilting mirrors*

CONTINUOUS PROJECTION BY OPTICAL COMPENSATION

First publication anywhere of data (direct from Germany), relative to the new Mechau sound-film continuous projector

H. A. Robiczek

IN order to present a moving picture it is known to be necessary to produce a stationary object before the eye in a rapid succession of pictures, each of which presents a timely and spatially different position, although the interruptions may not become too large. Processes of movement of everyday life, taking a minute have to be retained in about 1,000 film pictures, if jerky movements are to be avoided in the reproduction.

According to the principle of jerk (intermittent), conveyance of the film which, together with the Maltese cross and the shutter, have experienced general technical realization, the succeeding film pictures are presented to the eye in a really stationary position. The change from one picture to another, i.e., the film conveyance, is kept completely invisible to the eye, because of the shutter.

Through the protrusion of the shutter, intervals of darkness originate between the individual pictures, causing an uninterrupted change from light to dark. This continual change affects the ocular nerves and, through these, the brain and head nerves of delicate persons to a high degree. The personal discomfort to which such spectators are subject often is reflected in subsequent derogatory statements relative to the motion picture industry. In addition, film and mechanism, during jerky transport, are subject to particularly heavy wear, and films already showing perforation defects are not conveyed properly by the switch gear, thus not permitting maximum efficiency of presentation.

The Mechau Development

For these reasons, it has been the aim of expert workers since the introduction of motion pictures to replace the jerky film conveyance with a device for optical compensation of the film movement. All makers of motion picture projectors have tried their hand at solving this problem; hundreds of patents of the most varied description relating to this phase of the art have been filed, at enormous cost; but the actual solution was only recently achieved by E. Mechau, in cooperation with the Leitz Works, Wetzler, Germany.

With an apparatus with optical compensation of film conveyance, the individual pictures are no longer projected during the stationary position of the film, but during uninterrupted film conveyance. A part or entire revelation of this continuous film conveyance through a shutter, such as in Maltese cross projectors, would thus be superfluous. On the other hand, an optical device to project still reproductions from the continually moving film tape on to the screen becomes necessary.

Great difficulties were encountered in endeavoring to make the film movement invisible on the screen through an optical device including movable lenses, prisms and mirrors, and to move the projection of one film picture into that of the next one without pauses of obscurity. The idea of the optical compensation device of this machine is as follows:

Projection Process

If a film picture is situated at 1 (Fig. 1), and the mirror *c* is in position 1′, reproduction on the screen is caused at *f*. If now the film picture moves downward into position 2, a corresponding transfer of the reproduction on the screen is caused, if mirror *c* remains in position 1′ during the movement. If, though, it is simultaneously brought into position 2′, the reproduction remains at *f*, and its movement on the screen is optically compensated for. The same condition prevails if film picture and mirror arrive in position 3 and 3′, respectively, at the same time.

In the same instant the following film picture appears at 1, its movement also having to be compensated for. For this purpose the mirror *c* also describes a revolving movement around its spindle *h*

simultaneously with the tilting already mentioned, from position 1′ to 3′, and leaves the beam as soon as it reaches position 3′. Continuing, a second mirror commences the same route through the beam into position 1′ and terminates, similar to its predecessor, in position 3′. Thus the movement of the second film picture is cancelled, and the third mirror enters the beam.

In this manner eight sectoral plane parallel mirrors revolve about the spindle *h*, and a suitable gearing of the mirror turning device and the film conveyance ensures exact synchronization of film transport and compensating device. As the mirrors succeed one another without break, parts of two sector mirrors are simultaneously present in the beam for a minute space of time during each change of film picture.

Compensating Action

While one mirror is still compensating for the movement of a certain film picture, the next mirror has already begun to do the same with the following picture, so that in each change of pictures the reproductions of two successive pictures are transposed on top of each other on the screen. In the same measure now [as during the movement of the pictures, the receding mirror is caught by a gradually decreasing part of the beam, and the following mirror receives a proportionally increasing part of the light beam], the clearness of both transposed reproductions on the screen gradually changes, but leaves the actual clearness unchanged. Thus, without dark intervals, one screen view will always fade into the following, without enabling the eye to detect any change-over at all. The reason for this is that the movement of the tape, i.e., the change of pictures, is faster than can be followed by the eye. Only at speeds of less than 8 to 10 pictures per second is the changing of one picture into the next one visible.

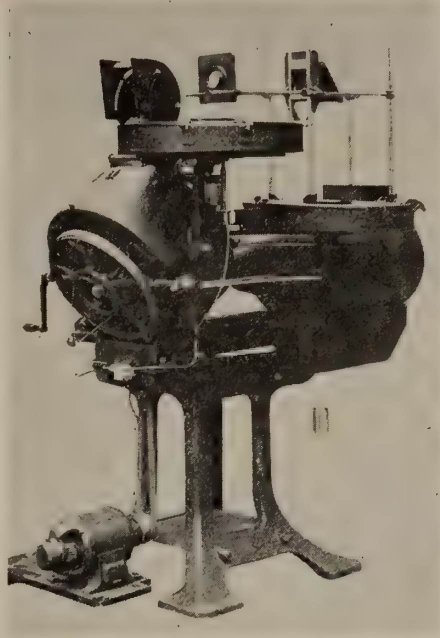


Fig. 3.—Mirror mechanism as seen from front and reverse

To avoid losing the extra light gained by the dropping of the shutter, through simultaneously projecting several film pictures, *the projection beam in the film track must be moved in synchronism with the movement of the film tape.* Therefore, a highly illuminated, square front window is projected on to the individual film pictures through a special objective, and the light beam projected on to the same mirrors before the film that effect the optical compensation behind it. Thus the sector mirrors are made use of twice, and produce vibrations in the beam also before the film, that cause the reproduction of the front window to advance with the individual pictures to a certain distance in the film track, then disappearing downward, to reappear above subsequently.

For the practical employment of the apparatus in scientific institutes it is of greatest importance that the clearness of reproduction remain constant, as it is thus possible to reduce the operating speed down to about 2 or 3 pictures per second; at this frequency, the individual pictures are clearly distinguishable, and enable an exact observation of even the slightest degree of development.

The full construction of the apparatus ready for use is shown in Fig. 4. The mirror arrangement is enclosed, oilproof and dustproof, in the inclined drum. Fig. 3 shows the front of the opened mirror casing, from which all sector mirrors except one have been removed to convey a better idea of the construction. The tilting movements of the individual mirrors causing the optical compensation are effected by the sliding of guide pins in a link of a special curved shape.

Recent Improvements

The latest Mechau model (Fig. 3), is remarkable for its particularly high degree of accuracy, and has been greatly improved and its efficiency increased to meet modern requirements in every way. Because of the uninterrupted, not jerky, film conveyance the machine runs almost noiselessly at any speed, and vibrations are entirely avoided. The constant and

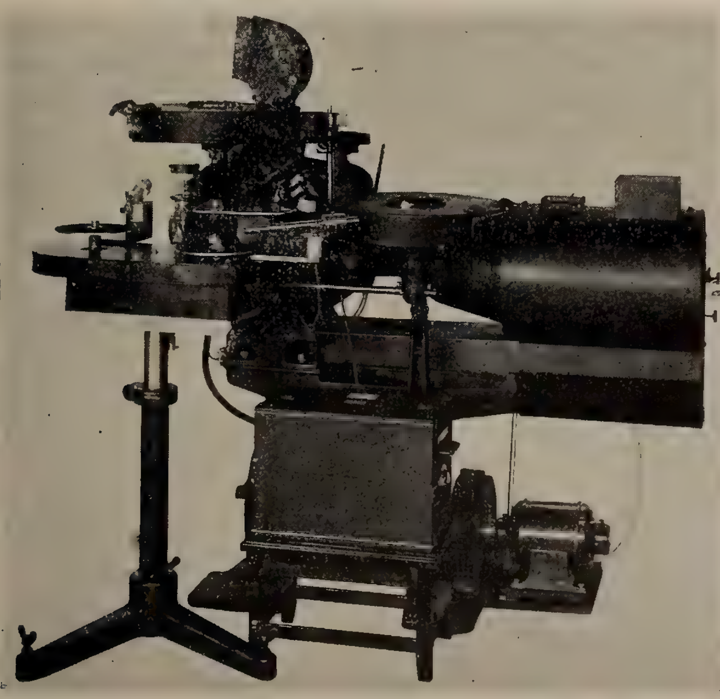


Fig. 4.—Full view of projector showing friction gear

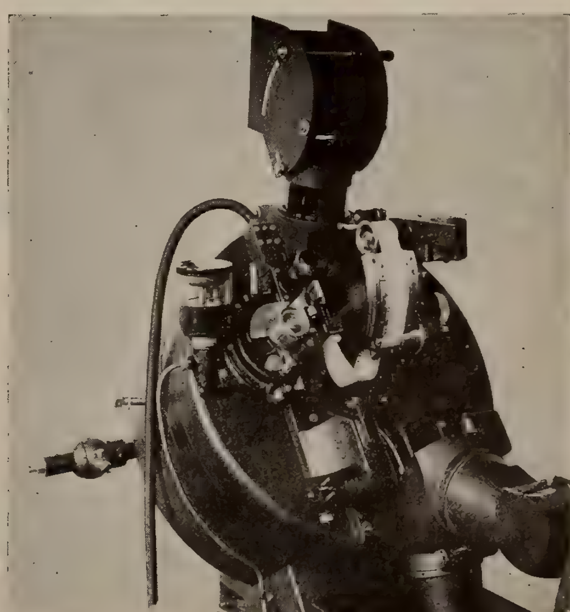


Fig. 5.—Projector with opened film guide and (at left) sound ray appliance

vibrationless operation of the apparatus makes it particularly suitable for sound-film reproduction; in fact, these features practically predestine this machine as the sound projector of the future, as of course, the sound film tape requires an entirely even run through the apparatus, and an absolute synchronism is attained through the even conveyance of the picture as well as of the sound film.

A further advantage, of special importance for sound film reproduction, is the noiseless operation of the driving mechanism. Scraping of the film, more or less present in all Maltese cross machines, cannot occur in this new apparatus. The careful handling of the film through the constant conveyance and its excellent guiding are advantages by which the sound film profits, since in the sound film considerable sound interruptions may be caused through the slightest damage to the film tape.

The sound-ray apparatus developed for this machine combines with the projector, as seen in the illustration, to an entirety. It is directly set onto it, and is driven by a gear fitted to the main spindle of the projector—thus variations in speed cannot develop between the projector and the sound reproducing appliance. For theater use the machine is to be preferred not only for its particular adaptability to sound film reproduction, but also because of its good protection against danger of fire. A self-acting shutter worked by a mercury pump automatically cuts off the projecting apparatus and the film guide from the arc lamp as soon as a speed below the admissible one has been reached.

The film drums are located horizontally, thus ensuring most careful manipulation of the film, of which reels containing to 4,000 feet can be employed. Special long leads to the drums cause burning film being drawn into the drum to be extinguished.

The source of illumination is a mirror-arc lamp with automatic carbon adjustment, contained in a double-walled lamp casing lined with asbestos.

Slide Projection

For the projection slide plates, etc., the light of the arc lamp is thrown upward by a folding mirror, contained in the lamp casing, on to a second mirror. From this the ray is projected through the diapositive and through a special objective in the usual way. Thus with the aid of the folding mirror in the casing, changing-over from film or sound-film reproduction to dia-projection is possible without any adjustment of the machine.

To obtain stepless speed regulation of the film picture, a friction gear is fitted between the motor and the mirror mechanism—this permits a minute speed regulation and allows the speed adjusted when starting to be kept constant without the necessity of any readjustment. The usual method of regulation by means of a resistance starter may enable an accurate degree of adjustment to be attained, but not a constant speed, as the ordinary resistance will vary in proportion as it becomes heated.

The stopping device often provided in Maltese cross machines is not required in this apparatus, as the optical compensation in itself already permits a speed reduction down to about two changes of pictures per second.

Comparative Worth of D. C. Power Sources (Addenda)

REFERRING to the article in your February issue by Samuel Bagno, regarding comparative worth of D.C. power sources, we have a few comments to make in connection with our experience along these lines.

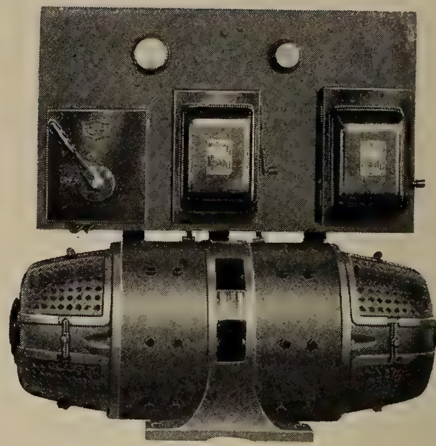
We have found that small compact motor generators of the single unit, two-bearing type prove very satisfactory for furnishing power to the exciting lamps and to the field circuits of the loudspeakers. A 4,000 mfd. electrolytic condenser connected across the generator terminals provides sufficient voltage for the most exacting conditions when the power is being furnished to the exciting lamp. No filter at all is necessary in connection with the field circuits of the loudspeakers.

M. G. Economy

We believe that motor generators of proper design are more economical for exciting lamp and horn field supply than any other source of power available, when all of the costs, including maintenance costs, are taken into consideration. The motor generator may be furnished with wool-packed sleeve bearings of liberal design, which require very infrequent lubrication. A few drops of oil every two or three months is all that is required. Bearings of this type require practically no more attention than ball bearings, and are quieter running.

As far as the brushes and commutators are concerned, if brushes of proper composition and design are used, there will be practically no wear of the commutator and only infrequent changing of brushes. The maintenance expense involved in connection with bearings, commutators, and brushes is practically negligible.

The motor generator is furnished with very close voltage regulation, so that one or two exciting lamps may be operated from it with very little change in voltage. This condition is not obtainable in other forms of power supply.



Esco two-bearing motor-generator set, with panel

Motor generators may also be furnished with suitable filters for supplying power to all of the tube filaments, in addition to the exciting lamps and field circuits of the loudspeakers. It is important to provide sufficient filters for each of the circuits, and to be careful that all the leads, etc., are shielded with metal. By this arrangement, the filtering is adequate to prevent objectionable noise in the loud speakers, and the voltage is maintained constant, whether one or two exciting lamps and photo-cell amplifier filaments are being operated at once.

It is probably advisable to use dry batteries for the photo-electric cell itself, but all of the other low voltage power supply often obtained from storage batteries may be obtained from motor generators with less maintenance expense, more reliability, and much less frequent replacements.

WILLIAM H. HAINES,
Electric Specialty Co., Stamford, Conn.

3,124 Advance Orders for New Cameron Book

"Questions and Answers," the new book by James R. Cameron and which is published by the Cameron Publishing Co., Woodmont, Conn., is proving to be the most popular projectionist book ever marketed by this company, according to an announcement of pre-publication orders received to date. More than 3,124 orders have been received for "Questions and Answers" prior to publication, and there is every indication that the 5,000 mark will be reached before publication of the volume on April 1.

Advance sales on this latest book is another indication of the leadership of Cameron books in the projection field. A large majority of projectionists buy Cameron books upon announcement and sight-unseen, so well established is the Cameron trade mark of quality. Inquiries on "Questions and Answers," as well as on all other Cameron books, may be addressed to Cameron Publishing Co., Woodmont, Conn.

LIGHT AND LENSES

Victor A. Welman

SECRETARY, CHAPTER 18, AMERICAN PROJECTION SOCIETY

II

OUR first talk on lenses put forward but one principle of optics in addition to a few applications of that principle. In the preparation and presentation of this material it was my hope that I could stem the tide of wrong thinking in connection with lenses and their use and perhaps stimulate a new line of thought and re-direct this thought into the proper channels. It is bromidic to say that misinformation, even if sprinkled with grains of truth, is worse than no information at all, yet we see manifestations of the truth of this assertion in all sorts of printed works and in lectures.

Once successful in directing our thoughts about lenses and light and how they and it are used in our daily projection work into the proper channels, it will be comparatively easy for the man with an inquiring mind and with the ambition to better himself to track down much valuable information on the subject.

The result of our last talk, as indicated by the questions put forward, by some of the answers to these questions, and by various remarks made showed clearly a wide divergence of opinion. This is not strange, for after thinking of ink lines on paper as "rays" over a period of years, and after reading books and magazines which seemed to substantiate such opinion, it was too much to expect an instantaneous about-face. I am aware of the fact, of course, that many did not believe all I said in my last talk; and I am also aware that changes in habit of thinking about any subject must be brought about slowly.

To those who still think that I advanced a "new" theory, and I know there are some who so think, I can only repeat that the basic idea of my thesis on light was first promulgated in the 17th century and that this idea still is presented in unchanged form in various textbooks. It was from these latest scientific and technical publications that the slides shown were made. The only originality was in presenting the ideas to a group of projectionists.

In this talk I will add nothing in the way of principles. The fact that light advances in wave-fronts, and varies in speed in different media, accounts for all the phenomena in which we as projectionists are interested. From this point on we shall deal only with practical applications of light.

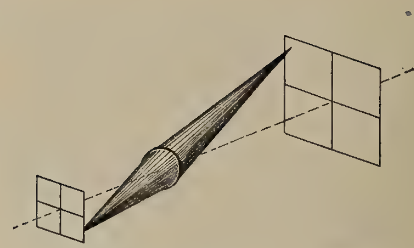
The Light Train

The light train from the arc to the screen may be divided into two classifications: (1) from the arc to the film, and (2) from the film to the screen. Endeavoring to attack this problem as *one continuous system* has been the undoing of many writers on the subject. I have tried many times during the past 15 years to make this point clear to inquirers and have not yet succeeded. I shall try again tonight; and with the subject a bit more clear in my own mind, I may succeed; for there is much merit in the view that a failure to successfully explain a point to another means that that point is not wholly clear in one's own mind.

I know that the idea that we must consider the light from the projection lens to the screen as diverging is quite general. Doesn't it so show up in this old stand-by (Fig. 1)? . . . diverging from the arc to the condenser; converging from the condenser to the projection lens; and diverging from the lens to the screen. Perhaps it has occured to some to wonder why a bi-convex lens used in front of an arc is called a *condensing lens* because it converges the rays of the arc onto the film, and then that a bi-convex lens used as a stereoptican lens is said to *diverge* or spread out the rays all over the screen.

We must remember, however, that we are dealing with *wave-fronts* and not with *rays*. That form of light with which we are dealing is shown in Figure 2. An illuminated point on the film sends out spherical wave-fronts, diverging, a small portion of which are intercepted by the lens and changed to converging wave-fronts which come to a point on the screen.

Figure 3 represents the pattern from one point on the film. Now, in your mind, fill in the pattern from a milliom points in a frame of film and then tell me where the rays cross! Since rays are wave-front directions and since wave-fronts are crossing everywhere, the expression "crossing point of the rays" loses its significance.



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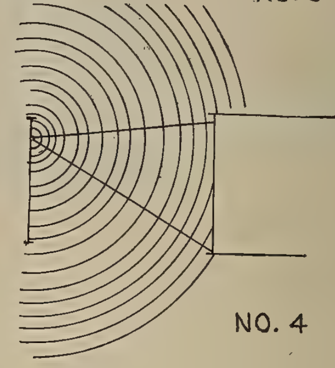

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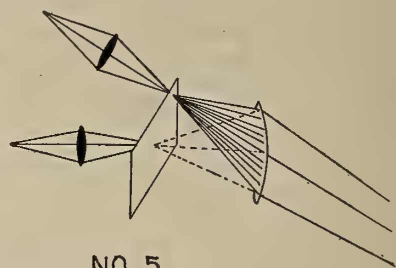

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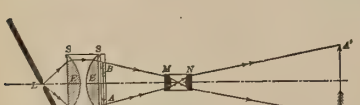
Action of Lens

Perhaps the custom of expressing the action in this fashion leads to the bad habit of thinking that the lens draws rays of light from the point in question. Of course, if we take the time to stop and think a bit we realize that the wave-front from the point really advances in all directions, as in Figure 4, and that the only purpose of drawing those boundary lines is to direct attention to the *only part* of the advancing wave-front that is acted upon by the lens.

I have considered the system in its simplest form from an illuminated point on the film to a similarly illuminated point on the screen. Now let us see how that particular point can best be illuminated, keeping in mind the fact that we are interested in illuminating a million separate points on that film and not the frame as a whole.

If we could develop some such method as is shown in Figure 5 by which each of the million points could be illuminated by a converging lens concentrating a minute brilliant point of light on it, we



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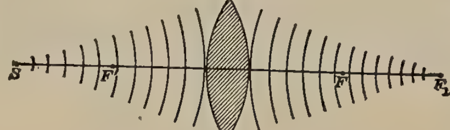

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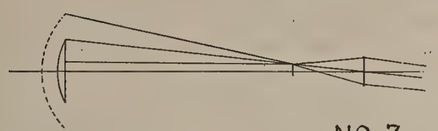

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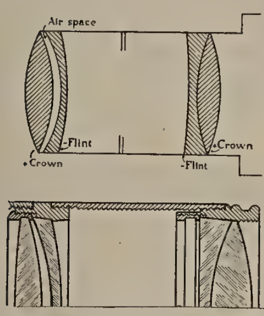

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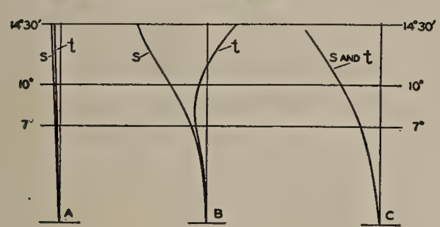


NO. 10

could get maximum brilliance; but we can't, so let us see what is the next best thing.

Consider first a central pencil of light (Fig. 6). We said that the ideal would be to concentrate the light on one point. Here we have it. The direct line on which this wave-front travels (shown by the middle line), does not change course. The front diverges from a brilliant grain of incandescent carbon in the crater to the condenser; then converges to a point on the film near the center; then diverges to the projection lens, and then converges to a point on the screen.

What happens when we get away from the central pencil? To get the proper viewpoint we must start at the screen and trace backward to find where the illumination needed must originate in order to give the necessary light upon the screen.

The lines in Figure 7 represent the boundary of a wave-front coming from one corner of the screen; it comes to a point at the corner of a frame of film. Now, to get the same amount of illumination at this point as at the center this wave-front should continue to advance along the same line. See where it lands. In order to furnish that illumination a 12- or 14-inch condenser would be required. A condensing lens of that diameter of the proper focal length to keep the arc within 4 inches of the lens (which must be done to get proper efficiency), would be so thick that spherical abberation would make impossible its use.

Reflector Arcs

Now, perhaps, you get a clearer idea as to why the reflector arc is so much more efficient than the straight arc. In handling wave-fronts the mirror acts just like a lens, except that the light passes through but a very thin thickness of glass. There is no difficulty experienced in making a mirror of 6, 8, 12, or 14 inches in diameter. The trend toward reflector arcs is thus inevitable.

First we had the 20-ampere lamps, then the 30-, 60-, and 70-ampere lamps. The next development will be 90- and 100-ampere reflector arcs, which I expect to see on the market this year.

The question of whether to use a 6½ or 7½ focus or any other focal length plano convex 4½-inch diameter condenser has become only of academic interest, due to the introduction of the reflector arc, and is no longer of interest to us. Previously it was almost wholly a matter of "cut and try." It could have been reduced to a certainty, but it never was. All that I have ever seen written on the subject approached the topic from the wrong angle, the theories upon which these expositions were built were fundamentally wrong, and the writers thereof endeavored to find an explanation for what was found in practice to be correct, instead of trying to determine theoretically what would be best and then attempting to reduce that determinaion to practice.

Bausch and Lomb undoubtedly dug into the subject from a scientific angle and, instead of trying to determine which of the popular combinations was best, found that none of them was even fair. They then began developing their Cinephor series of condensers, the latest of which is the cylindrical Series II now in use in the recent models of high intensity lamps.

Let us get back to the projection lens for a moment.

The Petzval Type

In 1840 Petzval brought out a portrait lens which worked at the remarkable diaphragm (for that period), of f/3.5, when at that time f/60 was considered good and when, in fact, portraits were very difficult to take because the subject could not sit still long enough to allow for sufficient exposure. I can't go too deeply into apertures just now, but suffice it to say that for a lens of 6-inch E.F. the free opening of the Petzval would be 1.7 inches, and of the f/60 it would be .1, so that the Petzval would have 17 times the diameter and would pass about 290 times as much light.

Owing to the large relative aperture, the Petzval was immediately adapted for lantern work. Figure 8 is a sketch of a Petzval lens taken from a book published about 40 years ago. This lens consisted of a cemented front combination of flint and crown glass and a back combination of flint and crown separated by an air space, the combinations being separated by a distance depending upon the focal length.

Let us look back to the state of science and industry in 1840. The arc lamp had not been invented; automobiles, telephones, and phonographs were missing. Railroads were just being developed, and the electrical industry as a whole was not even dreamed of. In thinking of the great development in other lines one might expect the projection lens to develop space. Let us see.

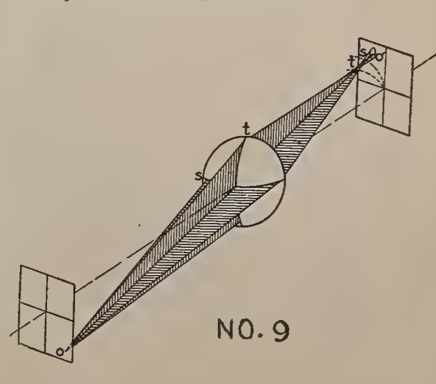
The lower half of Figure 8 was taken from a circular received recently from an optical company[1] describing their newest development in projection lenses[2]. Ninety years have not changed the fundamental design of projection lenses one iota. But, while the principle of the lens has not been changed within this time, there has been great development in the *execution of that design.* Hartung[3], after describing the Petzval as an extremely good projection lens says: "The Petzval objective must be very carefully constructed if it is actually to show its whole efficiency. Unfortunately, this cannot be said of most of the so-called projection lenses made on the Petzval formula."

So that while both sections of Figure 8 look identical, the newer lens, and all other lenses built on this formula, are good or bad not according to the design but according to the care and skill exercised in the *execution of the design.*

In this particular lens[2] it seems to me that the great advantage for projectionists lies in the fact that it is so constructed that if all the glasses and all the rings are removed and scattered about, they cannot be put back together in any way but the right way—certainly a great help to a hard-working service department.

The passing of the straight arc and the accompanying introduction of the Cine-

[1] Kollmorgen Optical Co.
[2] "Solex".
[3] "Optics for Photographers."



NO. 9

Table A (Based on B. & L. Cinephor Lenses)

Type	*Speed*	*Focus*		*Estimated Aperture*	*Actual Aperture*
Series O	f/3.5	5″	5/3.5 gives	1 3/7″	1 13/32″
Series I	f/3	5″	5/3 "	1 2/3″	1 23/32″
Series II	f/2.4	5″	5/2.4 "	2 1/12″	2 3/32″
Super Cinephor	f/2.3	5″	5/2.3 "	2 4/23″	2 3/16″

phor condensers have narrowed considerably the field of individual preference for projection lenses. The method generally used in the past in introducing newly developed projection lenses has been to try one out in a projector, with practically no consideration being given to the fact that the old lens is dirty and the new one clean. Naturally the new lens shows up well, by comparison, and sometimes the house buys it. I hope that this is no longer the practice here (Cleveland), as an actual screen test is the only sensible method in which to determine the value of any projection lens.

It is very important that we understand the "language" of lenses, in order that we may take advantage of the information on lenses which is disseminated through various channels. Much valuable information escapes that man who is not fully conversant with the "language" of lenses.

The 'Working Diameter'

One point often referred to is the "free aperture," or "working diameter" of a lens. Lens manufacturers endeavor to increase this aperture as much as possible. It might seem that in order to get a larger aperture all that is necessary is to make the glasses of larger diameter. While this is so, it must be remembered that, from the standpoint of the manufacturer every 1/16 inch added to the diameter of the lens very greatly increases the difficulty of securing a clear, sharply-focused picture over the entire screen.

The advantage of the larger aperture is that it permits the passage through it of more light. The photographers among you understand the subject, but from experience I know that sometimes you do not correctly apply your photographic experience to a consideration of projection lenses.

The speed of a camera lens is commonly rated as a fraction or ratio—the focal length divided by the so-called f-number, the quotient being the working diameter of the lens or of the diaphragm, if there is one. The smaller the opening in the diaphragm (that is, the larger the f-number), the clearer the picture and the greater the depth of focus, but the longer the time of exposure required.

The larger the opening (that is, the smaller the f-number), the more difficult it is to build a lens that will give a clear picture all over, but the less time required for exposure. Photographic lens have now been developed rated at f/4.5, f/3.5, f/2, f/1.7 and even less, according to some manufacturers' claims. When we pass f/1.5, however, we may be pardoned for having a doubt as to accuracy of such claims.

As noted previously, the projection lens started out on the Petzval formula with a claim of f/3.5 for portrait work. Most manufacturers of projection lenses did not claim better than f/4, however, and this size came to be known as a "quarter-size lens." It is possible that some of you have not known where that term originated. An f/4, five-inch focus lens would be 1¼ inches in diameter, which you will remember to be about the size of the old quarter-size lens.

Speed of Lenses

Half-size projection lenses began to come in, that is, lenses rated at f/2, but in this case the f/2 was theory only, for it is only within the last year or so that even an f/2.5 lens of good quality has been put on the market; and f/2 is still in the distance. Lenses have now advanced in development beyond the projector, for in many cases better lenses could be provided if there was room for them in the projectors. This deficiency will be compensated for, we hope, in the newly developed projectors.

In Table A is a representation of the dimensions of the various series of Cinephor lenses that are available, showing the free aperture and how it works out on the basis of the f-number. The Cinephor series is used because it is the only one on which I have aperture measurements.

You will note the steady progression from f/3.5 to f/3, f/2.4 and now f/2.3 for the Super-Cinephor. I have no information as to the construction of the latter type, rated at f/2.3, but I have no doubt that it is a modification of the Petzval formula which permits of correction for spherical and chromatic aberration and for astigmatism.

We touched briefly on these corrections in our talk last month. Referring to the illustration (Fig. 9), you will remember that our problem is to get *s* and *t* to focus together to correct for astigmatism, and also to get the two of them to lay back flat upon the screen to get flatness of field.

In Figure 10 are the curves representing the results of the corrections. In curve C, *s* and *t* stay close together, but the field is badly curved. Curve B shows an earlier Cinephor in which *s* and *t* are kept close together up to 7° with a fairly flat field. Anastigmats, or lenses which are corrected for astigmatism, are com-

(*Please turn to page* 29)

EXCITER LAMP DEPRECIATION

R. E. Farnham
COMMERCIAL ENGINEER, GENERAL ELECTRIC COMPANY

DEAR Mr. Finn: This refers to your letter of recent date inquiring as to the candlepower depreciation of the G.E. photocell exciter lamps. I should first like to correct one statement in your letter regarding the life of these lamps.

Both the 8½-volt, 4-ampere lamp designed for the Western Electric System, and the 5-ampere, 10-volt lamp designed for the Photophone System, as well as the 7½-ampere, 10-volt lamp formerly standard for the Photophone, have been designed for an average life of 50 hours when operated at their rated amperes, instead of 100 hours as mentioned in your letter.

Life tests of these lamps show that the candlepower drops about 10 per cent in the 50-hours life. This depreciation is due to a tungsten deposit on the inside of the bulb coming from the filament.

The effect of this blackening on the sound would be a slight reduction in sound volume necessitating advancing the gain control perhaps 1 point. There will be no effect, of course, on the quality of the sound due to bulb blackening. However, we do find that in some instances the filament coil sags slightly causing an uneven illumination of the small aperture inside of the optical system. This, of course, would result in a considerable reduction in sound volume and undoubtedly an effect on sound quality, particularly where variable area sound films are used.

However, the light sources of all three lamps mentioned have been so designed as to produce a somewhat wider solid band of light than called for by the optical system. Hence, some little sagging could take place before any effect on sound quality would be produced.

AN OPEN LETTER TO JAMES J. FINN

***From* Thad C. Barrows**

PRESIDENT, PROJECTION ADVISORY COUNCIL; PRESIDENT, BOSTON LOCAL UNION 182

DEAR JIM: I'll start by repeating that old bromide to the effect that I am not given to the habit of "writing to the papers," and this statement should absolve me from any "bouquets" which might come my way as a result of my deficiencies as an author. However, I certainly feel that your article "Wanted: A National Society of Projectionists" which appeared in INTERNATIONAL PROJECTIONIST for February is so unusual (from the standpoint of what you had to say and in reflection of the personal courage on your part in saying it), that we who hold positions of some responsibility within the craft should meet such honesty of purpose head-on and not attempt to duck the issue, or issues, involved.

I'll begin by stating my opinion that this particular article is easily the best thing you have ever done, is a job which should have been done long ago, and is one of the finest things that has ever appeared in a projection paper. I am unable to agree with those who hold this article to be inflammatory in any destructive sense; but I am quite willing to agree with the view that it is inflammatory in the sense that it puts Mr. Projectioninst "on the spot" and seeks to prod him into action.

Complimentary "Taffy"

I for one am tired of being told what great fellows we projectionists are and what marvelous work we turn out and how dreadfully important we are in the motion picture scheme of things. I for one am tired of all this taffy that is handed out to us by those who assert their friendship for us and who demonstrate this friendship (?) by feeding us cakes sugar sweet which are calculated to make us drowsy and lull us into a sense of false security. Taffy we can buy at any candy store. I for one would like the truth about ourselves from now on. And it does seem to me that we as a craft are just as important as we can make ourselves.

I shouldn't like to convey the impression that this letter is in any way a "boost" for you, for it isn't. While I agree with you in a broad sense, there are a couple of points of your thesis that do not meet with my approval. These couple points are rather small in comparison with the fact that your article really started something which I hope will bring results, and so can be glossed over.

It's about time we fellows sat back and took stock of ourselves. What are we, what have we, and where are we going? These are the questions we should ask ourselves. Furthermore, we should give considerable time to thinking over just what is it that makes us different from any Tom, Dick, or Harry who walks the streets today with a license in his pocket and an acquisitive gleam in his eyes (for our jobs). It's all very well to say that we shall fight these fellows through organization, but my idea is that we must fight with *organization plus*—plus that "certain something" which you mentioned and which you subsequently boiled down to "morale," "better training," and "better work."

I've heard the cry for education before, but you pulled something new (on us), when you sneaked in that socialization idea. I say that once embarked on a really worth while socialization program, the educational feature would take care of itself.

There can be no honest difference of opinion on your remark that we have but one thing to sell and that that one thing is superior work. This statement wins hands down.

Our Position in the Industry

I disagree with you on the point that projectionists do not realize their important place in the industry. I think that they do, and further, that there has been a growing realization of their importance among projectionists, particularly within the past four or five years. The trouble here is that projectionists are not exploited by themselves or by others—consequently there is very little said or written about them outside of their own periodicals. I have carefully checked up the comment about projectionists which appeared in other than projection publications over a period of six months, and I can state positively that more than 95 per cent of this comment had to do with wage scales. Nothing about our accomplishments, nothing about our fine fellows who risked their lives in tight places during theatre fires, nothing about our charity work, nothing about the outstanding personalities in our craft—what they are doing, what they are saying, and what they are thinking. Such is the place occupied by our craft in the minds of others in the industry.

It's futile to ask that projectionists themselves look after their interests in this direction (and here we come to your remarks about non-cooperation within the craft), as they really haven't time for such activity. An organization such as you outlined in your article would come in nicely here.

The tendency to "let George do it" is not confined to the projection craft. The phrase is popular with all crafts, all organizations, all industries. Just because of this, however, is no reason why we who have been asked to fill posts of some responsibility within the craft should not put our shoulders to the wheel and play the role of "George" for a while. It may be said, as you did, that projectionists are selfish and are "notoriously indifferent to any attempt to render them a service." True. But probably this is a result of having given their money for several things and then not received anything in return.

Publicity—Plus

You have often told me that publicity in itself is not the key to this problem of getting and holding adequate representation for the projectionist within the industry. With this view I agree. Publicity *plus a record of accomplishment of practical things* is what will bring results.

I have been a member of the International Alliance for

22 years. I was instrumental in the formation of Boston Local Union 182 and have held every office in the Union. For 15 years I have been President of the Union. I am now President of the Projection Advisory Council. I am a member of the Society of Motion Picture Engineers and am the only projectionist member of the Academy of Motion Picture Arts & Sciences. I cite this record merely to show that I have had the experience to know whereof I speak—and I say that *there never was a time when the projectionist needed a national educational society as badly as he does today.*

We know all this, we say. But the important question is "What are we going to do about it?" Are we going to "let George do it"? or shall we muster up the courage (and the dollars), to do it for ourselves?

On all sides about us we see outstanding projectionists giving freely of their time and effort for innumerable activities within the industry. We see work completed by projectionists which is of inestimable value to the industry—but we seldom see the craft as a whole benefit by this splendid work. Too true is your statement that we all have time for anything and everything, and everybody, except that which will reflect credit on our own craft.

I don't say that all this valuable work should be dumped merely because we projectionists as a group haven't sense enough or courage enough to get together and assert ourselves. Not at all. But I do say that it is damned shortsighted on our part to let the cream represented by the efforts of some of the outstanding members of our craft be skimmed off by others—with the craft having to sit back and take the skim milk when the bouquets are handed out.

Projectionist representation in other than projectionist societies within the industry is all very well and all that sort of thing. But it seems to me that, as far as the industry is concerned, we are projectionists first, and everything else second, and that we owe our first duty to ourselves as individuals and to our craft as a group.

I as an individual am perfectly willing to forfeit my privileges in all other educational and engineering societies and to resign my office as President of the Projection Advisory Council to support that man with a definite program for a projectionist society. And by "support" I don't mean that I will sit back and "let George do it." By "support" I mean that I will roll up my sleeves and go to work for that man, or group of men, who show any evidence of wanting to do a real job of organizing a national projectionist society.

By a national projectionist society I mean a society that will be run along practical lines, that will do practical work and will show the projectionist something in return for the money he is asked to pay in dues. Why couldn't we have one or two meetings a year—national meetings—at which representatives from all over the country could meet for two or three days and discuss the technical problems incident to our work? Why should we have to first have this data run through the hopper of any other society?

I'll resign my office as President of the Council tomorrow, or at any time in the near future, when a man, or men, with such a program as I have outlined previously appears. And I'll support that man or group of men.

Well, Jim, this is my story. I haven't rushed into this letter in any half-baked manner. It's two weeks since I read your article and I've been thinking it over ever since. The foregoing is my reaction. What I want to know is: when do we go, with whom, and to where?

Common Sense and the Common Cold

Leverett D. Bristol, M.D., Dr. P.H.
AMERICAN TELEPHONE AND TELEGRAPH CO., NEW YORK CITY

A FEW fortunate people never have colds, some people have as many as six colds a year, while the large majority of us average at least one cold annually. Colds cause more discomfort and loss of time and money among inside workers than any other disease.

The so-called Common Cold is caused by a virus or parasite that is spread from one person to another. Although this parasite is still unknown, it acts apparently by "pepping up" or making more poisonous the ordinary bacteria that exist in the nose and throat, thus giving rise to inflammation of the membranes of the upper respiratory tract.

While colds may be the direct or indirect result of such an infectious or "catching" organism, the resistance of the individual is of prime importance, as in most other diseases of this nature. While the resistance of the average individual against a cold is not high, all of us may do certain things that will tend to increase our chances for avoiding this troublesome malady.

The chief thing you can do to help prevent a cold is to develop good health habits. Remember that as yet there is no substance—solid, liquid, vapor or gas—that may honestly be called a "cold cure," in spite of the fact that some of these may give temporary relief. Favorite home remedies chiefly are of value for the other members of the family rather than for the one who is ill. Temporary relief and comfort for the patient naturally makes others happy and contented.

Vaccines apparently are of value in upwards of half the cases in which they are given, particularly in preventing the chronic complications of a cold. They may be worth a trial by those who suffer from repeated colds.

The cold fact about the common cold is that at the present time there is no drug store or medicine cabinet "magic" that will prevent or cure it. Common sense, which is only another way of saying Good Health Habits, is the best preventive and the best treatment of the Common Cold. This prescription of Common Sense should be taken in large doses, especially from November to May!

SOUND PROJECTION FACILITIES IN THE MODERN THEATRE

D. M. Cole

ELECTRICAL RESEARCH PRODUCTS, INC.

Sound and visual projection facilities in the Los Angeles (Calif.), Theatre represent the ultimate in completeness and efficiency. Public address, duplicate picture presentation, broadcast pick-up, and hard-of-hearing aids are the highlights of this installation, as described in the accompanying paper which was presented before the Fall, 1931, *meeting of the S.M.P.E. by Mr. D. M. Cole of the ERPI staff.*

THE trend in modern theatre construction is toward larger and better equipped theatres. Mechanical and electrical devices, which enable the exhibitor to furnish better entertainment and more comfort to patrons, are being used increasingly in new theatres, refinements being added as they become available.

The Los Angeles Theatre is an example which included in its construction and furnishings all available refinements. The acoustic properties of the theatre were given careful consideration and, hand in hand with good sound equipment, excellent results are being achieved. In addition to the sound picture equipment, various attachments and special features have been provided.

The sound facilities include sound picture reproduction, both film and disk, for three projectors; hard-of-hearing aids, non-synchronous attachment, broadcast pick-up, and public address systems. The amplifiers and control panels are mounted on five racks, centralizing all the panels, with the exception of the public address control equipment, which is located in a room adjacent to the projection room.

Sound Equipment

Two sets of amplifiers are provided, permitting simultaneous reproduction of two programs: *i. e.,* while sound pictures are being shown in the theatre auditorium, announcements can be made to other parts of the theatre, if required. The duplicate set of amplifiers insures sound in the theatre auditorium at all times. Switches have been used throughout in this installation, with the exception of the inputs connecting the microphones to the mixing panels, where jacks are used. Monitoring facilities for both systems are provided. Loud speakers of various types to fit the particular purpose are installed about the theatre to care for the distribution of programs.

The sound picture equipment is of the largest type of Western Electric equipment supplied for the *de luxe* theatres. The amplifier equipment consists of a voltage amplifier, a medium power amplifier, and two high power amplifiers. The amplifiers, with the exception of the voltage amplifiers, have "built-in" rectifiers and filters which furnish plate supply from alternating current. The plate current of the voltage amplifiers is obtained from the rectifier of the medium power amplifier with which it is associated. The filament supply for the medium and high power amplifiers is obtained from 110-volt A.C. stepped down to the proper voltage. The filament supply for the voltage amplifier is obtained from a motor generator set.

Horn control panels are provided for impedance matching and testing of the horn receivers. Pick-up equipment is provided to permit the reproduction of either film or disc records on any one of the three projectors. The equipment is of the universal base type.

Three shallow type stage horns, each equipped with two receivers, are used behind the screen for obtaining correct illusion and distribution of sound. A large sound screen, 60 feet by 40 feet, having a good frequency transmission characteristic and good light reflecting qualities, is installed.

The volume of sound is normally controlled in the projection room, but an auxiliary fader is available for use in various locations in the auditorium. The auxiliary fader is used for previews and premiere openings where special attention to volume is essential.

Duplicate Projection

In the Grand Salon a miniature screen is provided which enables patrons to view the picture which is being shown simultaneously in the theatre auditorium. The accompanying sound is reproduced by a loud speaker which is located above the screen behind the grille work.

Loud speakers are provided in two "cry rooms," enabling those viewing the picture from this point to hear the accompanying sound.

Hard-of-hearing aids enable partially deaf patrons to hear both the sound picture reproduction and stage programs. Single receivers, provided with head bands, are employed. A regulating device in the cord permits the patron to adjust the volume to suit his need. The cords are equipped with plugs which are plugged in receptacles installed on the arms of the seats. An A.C.-operated amplifier, which obtains a small speech input voltage from one of the system amplifiers, furnishes the power for these receivers and precludes the possibility of short circuits in the hard-of-hearing aid attachment from interfering with the operation of the system with which it is associated.

For the reproduction of incidental music recorded at 78 rpm., a reproducer set is installed in the projection room. Two turntables with a fader make possible the running of continuous programs for entrance music, exit music, and sound effects.

Radio Broadcasting

Two amplifiers are provided to furnish programs over telephone lines to radio broadcasting stations. Programs from any of the microphone pick-up points, including the broadcasting studio, can be transmitted. The amplifiers are all A.C. operated and the necessary impedance matching and isolating transformers are provided.

The public address portion of this installation consists of high quality micro-

(*Please turn to page* 28)

View of the miniature screen which enables patrons to see in the lounge the picture simultaneously projected in the theatre auditorium

NEWS and VIEWS

A collection of random thoughts, and some not so random; fact, fancy and opinion pertaining to the projectionist and projection matters. The free-for-all- forum.

Another Contribution on Film Mutilation

THE article on film mutilation which appeared in INTERNATIONAL PROJECTIONIST for February elicited the following interesting comment from James L. Caddigan, a member of Boston Local Union 182 and contact man for Paramount Public Corp. on film mutilation problems:

"Another bum print," an expression common in the vocabulary of projectionists, is usually voiced to a brother projectionist whose solution for the situation is summed up in his answer—'Oh Yeah!'

"Dependence is a poor trade to follow and projectionists who rely solely upon the film exchanges to furnish them good prints may find their confidence misplaced. Projectionists are neglecting a great responsibility. Every poor print received in the projection room should be reported immediately to the theatre manager who, in turn, should forward the report to the film exchange in question. The film exchange Inspection Department is in a sense like a dam in that it holds back from the theatres a flood of bad prints. The Inspection Department being a combination of mechanical and human elements, its perfection cannot be guaranteed and occasionally a weak spot develops in its structure.

"Hydro-power companies throughout the world keep a constant watch on their source of power (their dam), and an immediate report is made of any sign of weakness. A poor print is a warning of weakness in the structure of the exchange Inspection Department; and unless the exchange receives immediate notice of this condition, a serious leak might develop and flood the theatres with bad prints and bring disaster to the box office and to projectionists.

Cooperation with Exchange

An idea prevalent among projectionists and managers is that the reporting of poor prints is void of results. This is in error. If the report is addressed to the proper person in the exchange, the sender may be sure it will receive immediate attention. A leak is of no value to anyone and the projectionist should never hesitate to report a poor print, as he may find his neglect to do so a boomerang.

Bad reels and damaged film cases—in fact, any agency that tends to cause film mutilation and damage—should be included in these reports. The film exchange is desirous of serving good prints. Theatre and audiences are entitled to them—and with the exchange Inspection Departments and the theatres cooperating, poor prints would soon become a memory.

Mr. Corrigan's theme is that old yet ever new one of cooperation. He has done splendid work for Paramount on the film mutilation problem, and his all-around service in the cause of better projection is a credit to Local Union 182. But, we can see no reason for withholding now our oft-repeated statement that "cooperation" is very good as a banquet word but utterly futile when applied to film mutilation problems. Our stand is the same as ever: when and if the leaders in all branches of this industry get together and map out a sensible plan of procedure, and include in this plan a rider fixing a definite penalty for non-observance, then, and then only, shall we see progress made. These skeptics who doubt the necessity for such action need only make a few inquiries as to the working of the S.R.P. in order to be convinced.

Thanks, Mr. Corrigan.

Re: Intermittent

IN the fifth paragraph of the article "An Improved Method of Removing Intermittent" in your February issue, writes J. M. Rugino, the reference in the third line to S-446-G should have read "C-192-G," and the reference in the following line to G-1346 should have read "G-134-G." I don't know whether or not these are typographical errors, proceeds Mr. Rugino, but the fact remains that the article is valueless unless these corrections are taken into consideration.

For the information of Mr. Rugino and all others who may have pondered on this maze of gears, we should like to state that one error was in his original copy (he wrote the article), and the second error comes right home to our door via a typographical error. A stand-off.

After re-reading this article, we should like to supplement Mr. Rugino's statement by pointing out the need for making absolutely certain that the "O" on G-12 and the "O" on the flywheel are parallel with each other *before insertion.* After this has been checked, both these parts *are put in together.*

Attention!

HOW many projectionists have acted on the suggestions contained in the item relative to lower insurance rates which appeared in I. P. for February? Investigation has definitely established the fact that working conditions in modern projection rooms warrant a reduction in life insurance rates. If you have not already done so, examine your policies now and make application to the issuing company for a reduced rate. The facilities of I. P. are at the service of any subscriber desiring aid in this matter.

Mr. McCullough Speaks Up

R. H. McCULLOUGH, enterprising director of projection for Fox West Coast Theatres, writes in to say that we show a marked tendency to gloss over the more important (to him), field of sound reproduction and concentrate on "straight projection" topics. He feels that there is much of interest yet to be said about sound reproduction, and goes on to point out that the major difficulties of projectionists today lie with the sound equipment rather than with the "straight projection" 'equipment. He suggests an earnest effort on our part to establish projectionists' preferences in this respect.

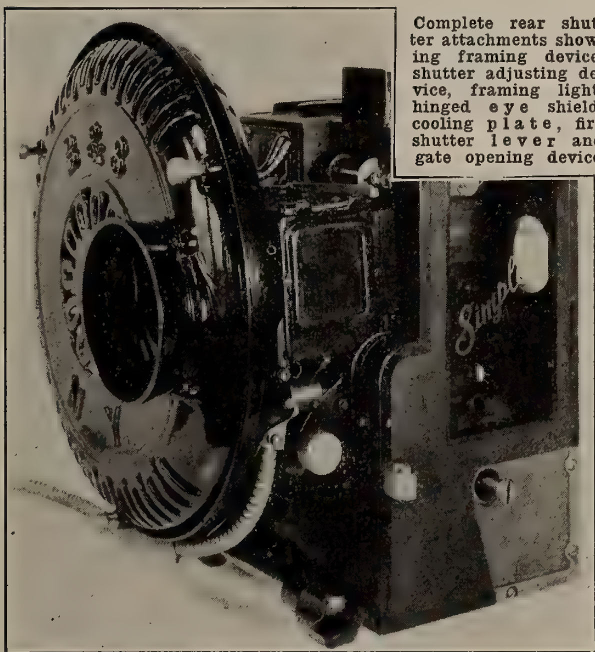
Mr. McCullough is both right and wrong—after the manner of an organization official who so adeptly blows hot and cold. He is right in saying that we have neglected sound projection articles; but he is wrong in ascribing the reason therefor. Most of the sound stuff offered to us these days reminds us of the story of Mrs. O'Leary"s cat which promptly changed color with every rainstorm: the same old cat, yet with a new dress. And so it is with the sound projection hash tendered to us these days. It's just hash —the old bromo offered in a new dress, with a new title and with new subheads. When and if we see something really worth while, it will be printed. Until then—a return to first principles.

As for ascertaining our readers' preferences, now that we have tried unsuccessfully for lo! these many years to do just that, we hereby appoint Mr. McCullough a Committee of One to handle the assignment.

These 'Goodwill' Parties

THE beginning of March marks the end of the social season for most local unions—that is, it is the time when all the really "big" parties have been thrown. If we attempted to weather all those parties to which we are invited during the course of one winter, we are cer-

TWO NOTEWORTHY ACHIEVEMENTS IN PROJECTION EQUIPMENT



Complete rear shutter attachments showing framing device, shutter adjusting device, framing light, hinged eye shield, cooling plate, fire shutter lever and gate opening device.

New Low Price: $85

B. & S. Rear Shutter

reduces aperture heat by 70%, minimizes effect of warped and buckled film, and keeps film free from dust and dirt. Exclusive blade feature of this shutter keeps hot air from film and insures constant supply of cool air around the aperture. The results of a test by the Massachusetts Department of Public Safety in a Boston theatre on January 19, 1930, are as follows:

Without B. & S. Rear Shutter
Aperture Heat: 1250° F.

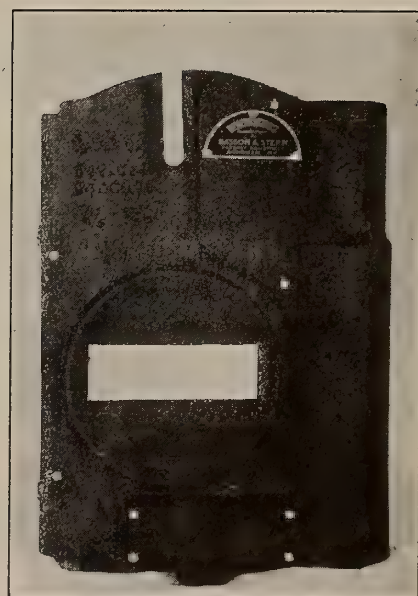
With B. & S. Rear Shutter
Aperture Heat: 340° to 350° F.

Installation can be made in one hour on any single- or double-bearing projector mechanism, without any cutting or drilling. Periodic oiling is the only maintenance requirement. Rear shutter equipment includes cooling plate, framing device, shutter timing adjustment, and a framing light. A hinged eye shield permits easy accessibility to the mechanism.

B. & S. Change-over

consists of two shutter blades contained in a housing designed for attachment to the cone of the lamphouse and operates on either A.C. or D.C., at 110 to 125 volts. Novel design eliminates any possibility of double exposure on the screen, and makes the change invisible to the audience. B. & S. Change-overs operate efficiently on either A.C. or D.C., but coils for the proper current will be supplied on specification. Coils of the B. & S. Change-over will stand up under heavy overloads and will not burn out.

The constant arcing in an ordinary change-over switch soon causes the metal contacts to burn and corrode. All B. & S. switch contacts are made of carbon that cannot corrode. B. & S. unique design also prevents the flash from touching any part of the switch. This switch cannot stick or bind and is positive in operation. B. & S. Change-overs have been used for many years in Publix, R-K-O, and other major theatre circuits.



Write for particulars to

BASSON & STERN

For fifteen years manufacturers of high grade motion picture equipment

749 EAST 32nd STREET, BROOKLYN, N. Y.

tain that we should be down and out within two months. Ducking these invitations is not a pleasant task, but duck them we must or else perish in the attempt to honor them.

We have often speculated on the purpose (we almost said "wisdom"), of all these parties. Ask any Local Union officer this question and it is a 10 to 1 shot that he will reply, "To promote goodwill." We can't see this angle at all, at all. Where is there goodwill to be found in an event which taxes the members up to the ears just to pay for half-fried squabs, rolls like iron, soup like mush, speeches by the yard and liquor by the case for a bunch of stuffed shirts who mean little or nothing to the average man in the craft? We can't see it. Instead of promoting goodwill such a party usually promotes bitterness and a lot of hard feelings.

These bad effects are heightened when a mob of exhibitors and others in the industry are invited to such an affair and at which they sit musing on just how much of their money in the form of wages goes to make such a show of opulence, such a glittering display. The next time around to these gentlemen for another two dollars or so and the job is really made just that much tougher.

Parties are all right—that is, if run along sensible lines. Local Union parties would be swell affairs if run by and for the benefits of the run-of-the-mill member and if the bars were thrown up against all these *outsiders.*

"The King Is Dead—"

BY this time it is no longer news that William F. Canavan, former President of the International Alliance, is now affiliated with Publix Theatres Corp. in an important executive position. As a matter of fact, we think that all local unions of the I.A. had the news the first day Mr. Canavan assumed his new duties.

The reaction of I.A. men to Mr. Canavan's association with Publix might be very interesting as a study in mass psychology, but beyond this it appears that the matter has no special significance. The situation does have a humorous aspect, though, as is evidenced by the following communication which we received recently:

"Well, Finn, it sort of looks as though your old friend Bill Canavan has put you 'on the spot' and, having put you there, has drawn the old hemp pretty tight. After reading your impassioned article exploiting the virtues of Canavan in your December issue I half expected to get the news of his canonization as one of our modern-day saints.

"What excites my interest about this matter is that which you will do next. You know, it probably would be all right with the intelligent gang if you just forgot about the matter and said nothing. But

Notice!

International Projectionist directs the attention of its subscribers and advertisers to its admission as second-class mail matter at the New York, N. Y., Post Office, as of February 8 last.

—how about the boys who are just lying in wait for your next issue so that they can see whether you pulled a 'Judge Crater' or tried to bluff your way out? For my part, I can see where you have only two choices: (1) you can keep quiet, or (2) you can say that you knew nothing at all about Canavan's intentions when you rushed into print in his defense. If you do the latter, you will take it on the chin anyhow, for the boys will conclude that you are awfully dumb and don't deserve any attention or support. What's the answer, Finn?'"

The Answer

The answer to my correspondent with the funny sense of humor is easy: it is that whatever we said about Bill Canavan in our December issue stands—only now it goes *double.* Should there be any doubt in the mind of any reader as to just what we mean by this, we wish to append the following explicit statements:

1. That Bill Canavan was the best President the I.A. ever had.

2. That on the day Bill Canavan walked out of the I.A. office and his salary stopped he owed the I.A. nothing and the I.A. owed him nothing.

3. That Bill Canavan still remains fixed in our mind as one of the finest men it has ever been our privilege to know, and that he still is regarded as one of the outstanding labor men of his time—even by those who profess to hate him (silly boys).

4. That Bill Canavan never "sold out" anyone, much less any group of I.A. men —except, possibly, in the minds of a bunch of electioneering parasites who want to go on feeding at the trough of assessments and the like.

5. That low-down politics of the most contemptible sort as practiced by a certain bunch of guys who couldn"t qualify for anything better than horsethieves rendered Bill Canavan useless to the I.A.

6. That Bill Canavan had the wage reduction proposal, as advanced by him *and as okayed by every leader worthy of the name in I.A. ranks,* figured out so closely that you couldn't have drawn a hair through the plan at any point without upsetting its balance. Don't take our word for it. Just look around now and see for yourself that that which Canavan proposed be done willingly is now being done grudgingly—and by leaving a bad taste in the mouth.

To those boys who figured we would either turn tail and run or take refuge in the safe but silly statement that we were mistaken, we suggest a re-reading of the foregoing. Those men now included on our already swollen subscription list who feel inclined to cancel as a result of the foregoing should do so promptly before they forget it. We are

publishing a paper that, whatever else might be the matter with it, certainly is honest and steadfast in its opinions.

Lower Insurance Rates

PROJECTIONISTS will be interested in the following communication from R. H. Flynt, Assistant Secretary of The Union Central Life Insurance Co., of Cincinnati, Ohio, anent the item on lower insurance rates for projectionists which we printed last month:

". . . . The article regarding lower insurance rates was noted with interest. . . . . Unfortunately, the information as to rates appears to have reached your publication not in exactly the form adopted. Under Class B, new rates, the double indemnity rating should be shown as double; likewise the rating for Waiver of Premium disability.

"I note your comment as to the possible ambiguity of the phrasing modern equipment." It would be our practice if we were in doubt as to modern equipment being used and the eligibility of an applicant for standard rating, to ask for an amendment containing questions which we believe would develop this matter in a way that would permit of a proper classification."

Interpretation

Projectionists are indebted to The Union Central Life for the initiative displayed in this matter. Mr. Flynt's reference to the procedure to be followed in a case where doubt exists as to the proper classification fails to wholly satisfy us that an injustice will not be done to a certain group of men not affiliated with circuit theatres. A questionnaire might develop some interesting sidelights on a given case, but we should like to know who at the insurance company office is going to interpret properly the replies to the questionnaire. "Standard equipment" might be the answer; but we have yet to meet or hear of anyone who can define "standard equipment" or who can explain what constitutes a "standard projection room." As an opening wedge into this vexing problem the action taken thus far is all right; but it will take considerably more work to put this question of insurance for projectionists into such shape as will be fair to all concerned.

Errata

In the article "Lamp Equipment: Operation and Maintenance," by R. H. McCullough, which appeared in INTERNATIONAL PROJECTIONIST for February it was erroneously stated that the cost of re-surfacing condensers is seven cents (7c) each. In the hope that orders for the re-surfacing of thousands of condensers will not be placed before the appearance of this item, we hasten to add that the correct price for re-surfacing condensers is seventy-five cents (75c), each.—*Editor.*

Alliance Items

Arrangements have been made to use the Neil House in Columbus, Ohio, which is situated directly opposite the Ohio State Capitol building, as headquarters for the forthcoming International Alliance convention. This hotel is in the center of the business, banking, shopping and theatrical districts of Columbus, which makes an ideal location. Also, the accommodations and moderate rates are most suitable for the purpose.

The convention sessions will be held at Memorial Hall, a beautiful and spacious auditorium, within a few blocks of the Neil House, which will amply care for the Delegates and guests.

The two members of the Sound Projectionists' Association who bombed the Midland Theatre in Kansas City, Mo., in their efforts to displace members of the International Alliance working at that house, and as a result of which one person was killed, were recently sentenced to life imprisonment.

•

With three circuits having already made arrangements for the return of acts, the biggest surge of vaudeville in more than a year is under way in the Midwest. Among those contemplating this policy is Publix-Dubinsky in Springfield and Jefferson, Mo.; the Butterfield Circuit in Lansing and Kalamazoo, Mich., and the Fox West Coast Theatres throughout Kansas and Arkansas, as well as the Publix-Great States in Peoria, Ill.

The following communication to General Secretary-Treasurer F. J. Dempsey anent the forthcoming Union Label drive by the Trades Dept. of the A. F. of L. should be of interest to all union men:

> A campaign in the interest of the Union Label, Shop Card and Working Button and to relieve unemployment among trades unionists, will be conducted by the Union Label Trades Department of the American Federation of Labor during the month of April, 1932. That the campaign may be successful, it is necessary that we have the united and wholehearted co-operation of all National and International Unions affiliated with the Department.
>
> Therefore, you are respectfully requested to communicate with all local unions under your jurisdiction, asking that committees be appointed to conduct an active campaign during the above named period. As soon as these committees are appointed, the names and addresses of the chairmen should be forwarded to John J. Manning, 202 A. F. of L. Building, Washington, D. C. All communications pertaining to the campaign will be forwarded to chairmen of committees unless otherwise directed.

•

On February 26th the U. S. Senate voted to outlaw the so-called "Yellow Dog" labor contract. Without a record vote, the Senate retained the provision of the Norris anti-injunction bill denying legal recourse to parties to such contracts, under which membership in labor unions is denied.

The action was taken shortly after the Senate had retained in the bill the declaration of public policy supporting the right of labor to organize.

Sound Projection Facilities in the Modern Theatre

(*Continued from page* 23)

phones of the condenser type, with their associated amplifiers, control equipment, voltage and power amplifiers, switching panels, and loud speakers of various types. Microphone outlets are provided for pick-up from the footlights, stage, the orchestra pit, broadcasting studio foyer, check-room, and lobby. Provision is also made for a hanging type microphone over the orchestra pit. Suitable mountings are provided, depending on the location in which the microphones are used and the function which they perform. The microphones are of the same type as those used in field and studio recording. A 200-volt dry battery is provided to furnish the polarizing voltage for the condenser microphones and the plate supply for their associated amplifiers.

The low voltage supply for filament current and grid potentials is obtained from the filtered output of a motor generator set. The amplifier associated with each condenser microphone is so constructed that it is not disturbed by shocks, this being accomplished by means of spring suspension construction. The microphone pick-up control panel is located in a room adjacent to the motion picture room. From this point, the operator can observe the results of amplifying speech or music in the auditorium. The mixing facilities enable the operator of the public address equipment to blend the output of any three microphones, as required. Standard studio equipment is provided for this purpose.

The public address amplifying equipment consists of two voltage amplifiers, a medium power amplifier, and two high power amplifiers. It should be noted here that additional voltage amplification over that needed for sound picture reproduction is required for public address work. The power required to operate the public address amplifiers is obtained in the same way that the power for the sound picture amplifiers is obtained. The medium power amplifier is capable of furnishing the plate supply for two voltage amplifiers.

For general reenforcement work in the theatre, large horns equipped with high quality receivers, are located over the proscenium arch and in the right and left organ grilles. During operation, the volume is maintained at a point which

creates the illusion to the patron that the reinforced sound is coming from the real source. The relation of the horns to the pick-up source is very important, and in general it is essential that the horns be located directly over and a little forward of this point. The dynamic loud speakers, instaled in the "cry rooms," the Grand Salon, the Main Lounge, and the foyer, furnish incidental music to patrons entering and leaving the theatre and to those waiting about for one reason or another.

Power Supply

The low voltage power supply for the entire installation is obtained from two motor generator sets with associated fillters. The motor generator sets can be used interchangeably and, in emergency, either set would handle any load which might be required to keep the show running. They furnish low voltage to the condenser microphone amplifiers, the voltage amplifiers, the film reproducer amplifiers, signal circuits, and the fields of the horn receivers. The remainder of the equipment, including the power amplifiers, operates from the standard power supply. A voltage control cabinet is provided to care for fluctuations in the line voltage.

All the equipment is of the very highest quality, from a mechanical and voice transmission standpoint. With the service rendered by the supplier of the equipment and the excellent work of the theatre personnnl, the system has been kept in operation with a minimum of trouble, in spite of the fact that the theatre operates during long hours. Close co-operation between the theatre management and the manufacturer of the equipment insures maximum use of the equipment, particularly the public address and special features.

There are indications that the larger first-class motion picture and legitimate theatres will soon be equipped with facilities similar to those enjoyed by the patrons of the Los Angeles Theatre.

Light and Lenses

(*Continued from page* 20)

mon enough in photography, but on account of the very large relative aperture of the projection lens it is very difficult to correct for both astigmatism and curvature of field without losing definition at the center of the screen because of spherical aberration.

New Developments

Curve A illustrates the claims for the new Super Cinephor, showing *s* and *t* together and with both curves being almost vertical, thus indicating an unusually flat field. Other curves of the manufacturer support the claim that in addition this lens is also corrected for spherical aberration, so that it is just as clear in the center as the other lenses which are not corrected for astigmatism.

You will remember that in the last talk we found that a 7° angle represents a lens corrected for the present standard film, and that the 14° angle represents the necessary correction for wide film.

The matter of aperture enters into one other question which has been frequently asked in the last year or so—that is, whether it is practical to change the focal length of a projection lens by varying the separation of the combinations. The answer is "Yes, within certain limits." In fact, the focal length of any projection lens depends directly upon the separation of the elements according to this formula:

$$F = \frac{f_1 \; f_2}{f_1 + f_2 - e}$$

You will note that as the distance be-

tween the elements increases the denominator of the fraction gets smaller and the focal length increases. As *e* decreases the focal length of the combination will decrease.

There is one limiting factor, and, within the limits of the use now made of variable focal length of objectives (that of changing from a .906 frame to an .800 frame), it is not serious. As the elements are drawn apart the effective, or free, aperture of the lens combination is made smaller and less light will pass through.

I think that this can be shown by referring again to Figure 7. A line is used here to represent the lens; but suppose that line represented only the back element next to the film. You can readily see that in placing the second element, the closer it is placed to the first element, the more of the light from the edge of the picture will be picked up by the second element. Separating these elements allows more of the light from the edge of the film to strike the barrel, and the effect on the effective aperture is the same as if the elements had been left close together and a diaphragm introduced.

LUXTRON A NEW ENTRY IN PHOTO CELL FIELD

A VERY simple but powerful photo cell, known as the LuxTron "ST" type, together with a new "R-1" relay, has been made available at a price within the reach of all. The LuxTron cell operates at only 22.5 volts and is rugged enough not only for experimental, but for practical, commercial applications. This cell may be classed as a "photo conduction" or "photo resistance" device. Its functional characteristics are such as to vary its electrical resistance, or conductivity, on exposing it to a source of light.

Because of the large current change resulting from light exposure, obtained by the use of the LuxTron cell, it is possible to operate a relay directly without the necessity of employing amplification. This simplifies the circuit and greatly reduces the cost.

A complete photo cell kit is being marketed by the LuxTron Devices Company, 338 Berry Street, Brooklyn, N. Y. The new LuxTron kit contains all the essential components needed to start in the light-operated control field. Included in the kit are a light-sensitive LuxTron cell, a relay for controlling a 110-volt circuit, a gum-wood relay cabinet and a complete set of instructions and diagrams.

ERPI P.A. FOR ZIEGFELD

The Ziegfeld Theatre in New York is the latest theatre for musical plays to install the Western Electric Public Address System to insure adequate sound amplification and transmission from the stage to every part of the auditorium. The necessary horns, amplifiers and microphones are being installed in time for the opening week of the new Ziegfeld revue "Hot-Cha."

FULCO SERVICE PLAN

A new service policy on Fulco projectors that provides for the replacement of all parts that are defective in materials and workmanship without charge either for labor or parts, during a period of six months, has been adopted by the E. E. Fulton Co., manufacturers and distributors of motion picture equipment.

In addition to the provision for the elimination of both parts and labor charges, the new service policy, the company states, entitles one to a five year guarantee, in which they guarantee Fulco projectors not to exceed a maintenance cost of more than $25 a year, for 5 years.

OVERSEAS DEVELOPMENTS

A new system of stereoscopy is announced by the French newspaper "Paris-Midi." The invention has been kept a strict secret, but it is said to be based on the filtration of light rays through multiple lenses. Only the eight experimenters are said to know the exact details of the system, researches having been conducted in a secluded laboratory. More than twenty patents have been taken out as protection.

NOTES *from the* SUPPLY FIELD

WEBER PORTABLE SOUND REPRODUCER READY

COMPLETION of a new sound reproducing attachment for all makes of 35 mm. portable projectors has been announced by Weber Machine Corp., of Rochester, N. Y., makers of the Syncrofilm reproducer. This new sound head represents a radical change from conventional practice in that the projector is driven from the sound head. Any 35 mm. projector can be combined with this new attachment in a very minimum of time and without making any alterations to the projector mechanism.

Sound Head Drive

The driving motor is within the sound head unit, which insures a smooth even feed of film at the point of reproduction (light source). The projector is driven from the sound head by means of a flexible shaft which is of sufficient torque elasticity to prevent any uneveness in operation or in sound reproduction. Provision has been made for maintaining a loop of film between projector and sound head, thus preventing any projector mechanical imperfections (irrespective of projector type or make), from interfering with the positive feed of film in the sound head. This feature also eliminates the necessity for perfect alignment of projector and sound head.

The film control mechanism in the sound head is of the very finest material and workmanship. The film sprocket is of the hardened and ground intermittent type. All bearings are of special bronze alloy or ball bearing type.

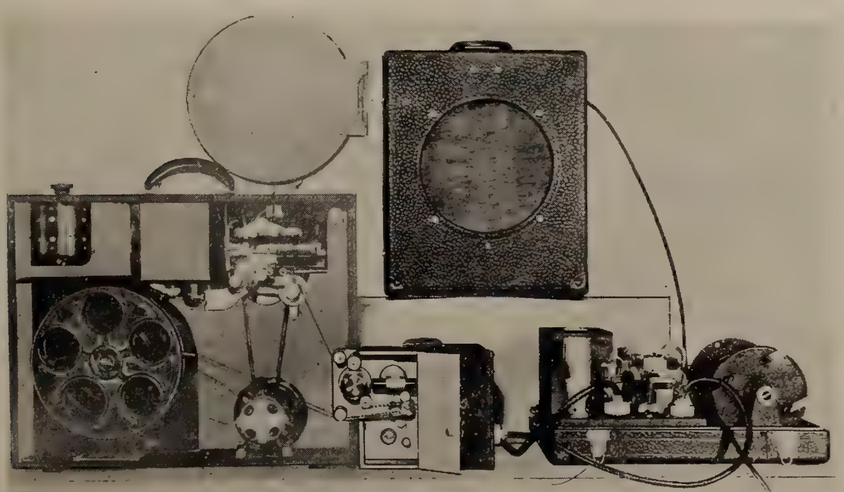
Purely Optical Slit

A "slitless" optical unit, permitting a more intensive line of light within a given width than is possible with any other method, is a feature of this equipment. This type unit has contributed greatly to the Weber Syncrofilm theatre installations.

All parts which are subject to wear through contact with the film are chromium plated. The case is of a special aluminum alloy finished in black crackled enamel and having a convenient leather handle for carrying. Polarity plugs are built into the sound head to facilitate easy and rapid connection of supply lines to the amplifier.

In operation, the film is drawn over the light aperture in the film control drum by means of a perfectly filtered driving mechanism, independent of the projector, thus insuring faithful reproduction of sound without distortion, irrespective of possible projector defects. These sound heads can be supplied separately or with amplifier and speaker, as desired.

The amplifier is contained in a suitcase and is very compact. It is designed for complete A.C. operation and can be used for either one or two projectors. A dynamic speaker is mounted in the cover of the case.



BLUE SEAL INTRODUCES THE 'TREATIZOR' ATTACHMENT

IT is well known that unprocessed film tends to accumulate emulsion on the projector tensions shoes. This formation of emulsion greatly increases the tension applied to the film and imposes a strain on the sprocket holes, thus causing damage to the projector as well as to the film. Many fires are caused by this clogging at the aperture, in addition to the film damage done. The article in INTERNATIONAL PROJECTIONIST[1] for February cited one such case which was decided by an arbitration board in favor of the distributor.

Film mutilation is now one of the prime interests of the S.M.P.E. and is the subject of thorough investigation tion by the Practical Projection Committee. "Noiseless recording" represents the expenditure of considerable sums of money, yet when prints reach the theatre they are either dirty, gummed or scratched, and the expense and labor involved in perfecting "noiseless recording" is of no avail in effecting improved results.

Bearing directly upon this problem is the recent announcement of "Treatizor" by the Blue Seal Products Co., of Brooklyn, N. Y. This device, which is fully protected and the name of which has been registered, removes oil, dirt, gum, grease and other waste from the film *as it runs through the projector.* In the same operation, new film is so lubricated that it will not cake on the tension shoes. Statistics show that approximately 90 per cent of aperture fires have been caused by this gumming.

Serves Dual Purpose

The Treatizor is of simple design and is assembled in one unit. To attach it the projectionist simply removes the top magazine and film valve casting, attaches the Treatizor and then replaces the magazine. Installation requires but five minutes. A tank, which is part of the assembly, is then filled with a special fluid provided and, after a slight adjustment is made to regulate the flow of liquid, is ready for operation. This tank adjustment also has a lead to a safety valve placed over the aperture which is automatically released should a fire break out in the top loop and thus would release the entire contents of the tank and douse the fire.

The fluid provided is a combination of carbon tetrachloride and other chemicals and has definite lubricating as well as preservation qualities. It has been demonstrated that this fluid returns to the film those solvents which have been removed by the heat.

Action of Lubricant

In utilizing this device the film is threaded through two pads which supply the fluid to and simultaneously remove all foreign matter from the film. The liquid disperses the heat from the film by evaporation as the film passes through the aperture and thus aids in preventing buckling.

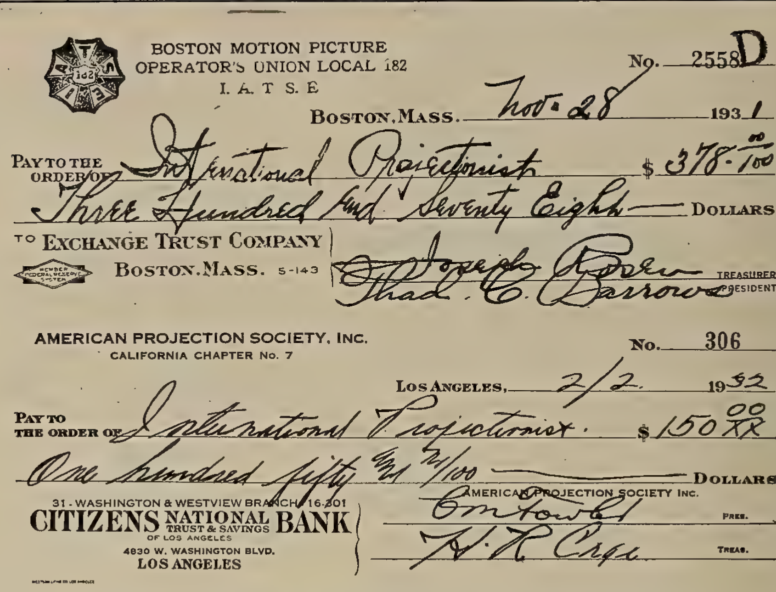
Tests conducted over a period of ten weeks in several large circuit theatres in New York City have demonstrated the efficiency of the Treatizor.

[1] "Damaged Film: Deficient Equipment and the Responsibility Therefor," by J. J. Finn. International Projectionist, February, 1932, p. 17.

Eight hundred applications for motion picture patents were made to the British Patent Office last year. This compares favorably with previous years.

Ip

The mark of a quality projection paper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'SOFT' AND 'HARD' LIGHTING WITH SUPERSENSITIVE PANCHROMATIC FILM

James J. Finn

THE volume and nature of comment induced by a recent article[1] on motion picture lighting by the present writer indicated a widespread reawakening of interest in this topic which is of such vital importance to the present and future welfare of the industry. While photography in itself is not regarded as being of primary importance to those who are interested mainly in the field of reproduction, it should be, for the reason that photographic values eventually may be translated in terms of projection values wherever motion pictures are shown. It is axiomatic that nothing beyond that which is contained in the film print can be projected upon the screen. So much for the importance of the subject.

Among the mass of comment received in connection with the article previously mentioned were several pointed suggestions bearing on the desirability of developing in detail the statements which appeared therein—or, in other words, a demand arose which might best be expressed by the query: "What are the facts in this matter?" The task of providing the answer to this query will be essayed in this article.

The advent of supersensitive panchromatic film has introduced a new element into the quality of photography obtained from various sources of illumination. The older conceptions of "soft" and "hard" lighting have been practically reversed by the introduction of this new and faster photographic material.

Contrast vs. Speed

The panchromatic film in use prior to 1931, while sensitive to yellow, orange and red, was much more sensitive to blue and violet. The panchromatic carbon arc and the incandescent tungsten filament lamp, both much stronger in yellow, orange and red rays than in green, blue and violet, compensated for the low sensitivity of the film at the red end of the spectrum. This gave a wide range of gradation, approximately orthochromatic color rendering and a soft pleasing quality to pictures made under this type of lighting.

The white flame carbon arc differs from the panchromatic arc and the tungsten filament lamp in that the energy emission is approximately the same for all colors. Color rendering in photographs made under white flame carbon arcs consequently conforms closely to the color sensitivity of the emulsion. With the older panchromatic film, white flame arcs reproduced blue and violet in very light tones, while red and orange were relatively much darker. This resulted in pictures with very sharp contrasts and led to the use of the term "hard" lighting in referring to the white flame carbon arc. This over-correction of blue and under-correction of red could be equalized by the use of filters, but only at a loss of speed.

During the past year new panchromatic materials have been introduced to satisfy the demand for increased speed. Improvement has been attained largely through increased sensitivity to red, orange and yellow. This improved sensitivity to the longer wave-lengths has greatly increased the speed permissable with daylight and the white flame carbon arc, but even greater relative increase in speed has been made possible with panchromatic arcs and incandescent lighting, since these sources are strongest in those colors to which the sensitivity has been increased in greatest proportion.

The change in relative sensitivity of these new photographic materials to the blue and red portions of the spectrum has an influence on the quality of photography which is of great importance to not only the photographer but to the industry as a whole.

Reversed Color Sequence

Decided over-correction of red, orange and yellow result when panchromatic arc or incandescent lighting is used without a suitable filter. The same sharp contrasts and "hard" effects obtained with white flame arcs on the old panchromatic film, are now obtained with this new material from the more yellow sources of illumination. The principal difference is that the color sequence is reversed. Red is now reproduced too light, orange and yellow practically white, and green and blue much too dark. In addition to sharp contrasts, this results in decided flatness and poor modeling of flesh tones.

The white flame carbon arc, on the other hand, is well adapted to the color sensitivity of the new film, giving excellent gradation for all colors and a pleasing softness of pictorial effect. Former conceptions are now reversed. "Soft" lighting means white light; while "hard" effects result when yellow, orange and red rays predominate.

Comparative Tests

The foregoing facts are clearly illustrated by a series of still photographs made under various sources of illumination on film sensitized with the same material now used in the motion picture studios.

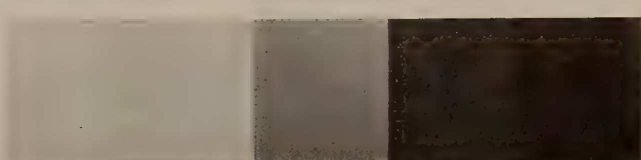
Exposures were first made to determine the relative speed of this film with different sources of illumination, using a subject free from color. The subject was an eight-by-ten-inch chart composed of five bands of neutral gray ranging from white through three intermediate shades of gray to black. A small portion of this chart is illustrated in Fig. 1.

This chart was photographed in full size under three different types of illumination—white flame carbon arc, panchromatic carbon arc, and clear bulb incandescent tungsten filament lamps. All three light sources were placed in the same position relative to the subject and were operated at the same line wattage. No filter was used in this or the subsequent color test and all light sources were unscreened.

With each negative the film holder slide was first withdrawn one inch and a brief exposure made. The slide was then withdrawn another inch and the negative given a second like exposure. The completed negative, exposed in this manner, comprised ten bands of exposure, representing intervals in the proportion of one-to-ten. Fig. 2 illustrates the appearance of the negative thus obtained.

All three negatives were given the same development, and by comparison

Figure 1



[1] *"The Indictment Against 'Soft Lighting'," by J. J. Finn, International Projectionist, December, 1931, Vol. 1, No. 3, p. 20.*

Figure 2

for blocks of equal density it was possible to determine the relative photographic speed of the three light sources for supersensitive panchromatic film. The equivalent exposure times, thus determined, were in the proportion of 10 for the white flame carbon arc, 12 for the panchromatic carbon arc, and 30 for incandescent illumination. These factors of equivalent photographic effect apply, of course, to an even balance of all colors, such as given by a reflecting surface of neutral gray.

Reaction to Color

A second test was then made to determine the reaction of this film to color under the same light sources. In this test, a fourth quality of illumination was introduced: a combination of white flame and panchromatic carbons.

The subject chosen for color comparison was a basket of fruit containing tomatoes of deep red color, a pepper of lighter red, pears which blended from red to yellow, a peach, oranges, bananas, lemons, a cucumber, a green pepper, a plum and concord grapes. The weave of the basket was untinted, but the rims at top and bottom were a deep orange color.

There being a wide range of variation in the color of fruit, a chart of three standard colors was placed immediately back of the fruit basket to afford a definite basis of comparison. The blue panel was a blend of 25 per cent Prussian blue with 75 per cent No. 1 white; the green panel was emerald; and the red, vermillion. Back of these color panels was placed the chart of neutral grays used in the previous speed test. The upper part of this chart is visible in the illustrations showing five blocks ranging from white through three tones of gray to black.

The same stop was used on the camera for all four exposures, the negatives given the same development and the prints identical time and treatment. Exposures were adjusted in proportion to the information obtained from the speed test, the relative exposure being 10 with white flame carbon arc, 12 with panchromatic carbons, 11 with the combination of white flame and panchromatic carbons, and 30 with incandescent illumination. Distance from the subject, direction of light and line wattage, as in the speed test, were the same for all sources of illumination. The four photographs thus obtained are here reproduced, without retouching, with legends indicating the source of illumination and the relative exposure time.

Comparison of the band of neutral gray tones at the top of each photograph shows that, in a photographic sense, these four exposures were identical although the actual time of exposure varied over a range of one to three. It will be appreciated, of course, that with a subject in which the redder tones predominate, the speed advantage of the white flame carbon arc would be less than that indicated by these tests; while, with a subject in which green, blue and violet tones predominate, this advantage would be greater.

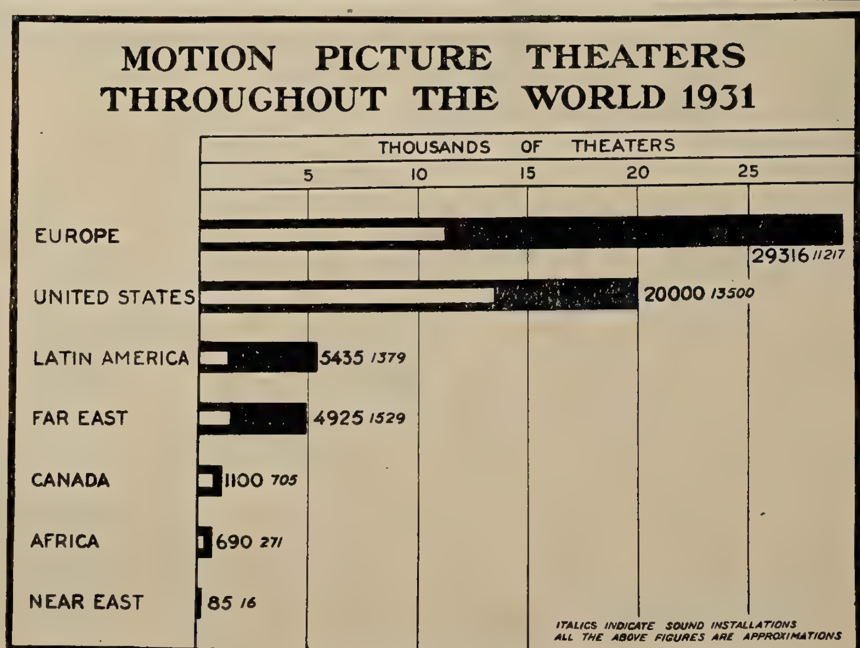
Conclusions

This series of photographic tests clearly demonstrates the accurate rendering of color values, excellent grada-

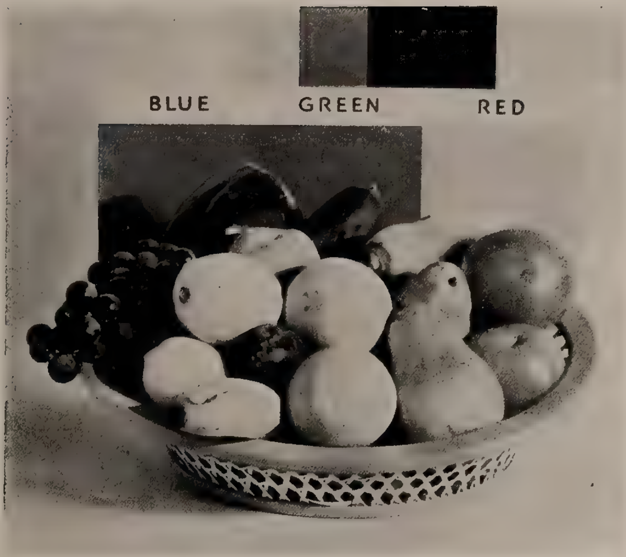
Latest Bull-etin

Our roving correspondent wires in the following dispatch from the hinterland, so that our readers may not be without at least one hearty laugh this month:

"Operators' locals throughout the country are expected to follow the lead of Local 306, New York, in accepting 10 per cent reduction in wages from major circuits affiliated with producing companies. These local organizations are understood to have been waiting for Local 306 to determine a course in the situation. Representatives of the circuits are expected to immediately start negotiations with the locals in an effort to bring about a reduction."

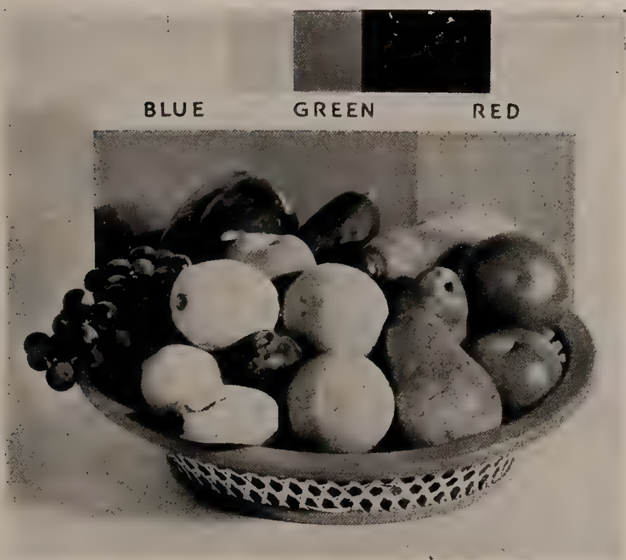


Courtesy, Motion Picture Division, U. S. Dept. of Commerce



Panchromatic Carbon Arc
Relative Exposure 12

White Flame Uppers—Panchromatic Lowers
Relative Exposure 11



White Flame Carbon Arc
Relative Exposure 10

Incandescent Tungsten Filament
Relative Exposure 30

ILLUSTRATING COMPARATIVE EFFICIENCY OF VARIOUS LIGHT SOURCES

This series of unretouched photographs clearly demonstrates the superiority of white flame carbon arc illumination for use with supersensitive panchromatic film, judged on basis of (1) *remarkable depth, creating an atmosphere of reality;* (2) *full roundness of modeling, giving true impression of form;* (3) *distinct separation of colors and natural blending from deep to lighter hues;* (4) *accurate reproduction of color tone values, with no over-correction and consequent flatness;* (5) *pleasing softness of pictorial effect combined with sharp definition of details, and* (6) *striking advantage in photographic speed*

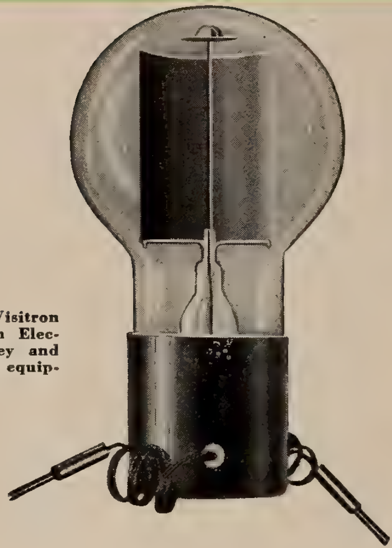
tion, superior modeling, absence of over-correction and consequent flatness, pleasing softness of pictorial effect combined with sharp definition of details, and the striking advantage in photographic speed obtained from white flame carbon arc illumination with supersensitive panchromatic film.

This, then, is the answer to the query: "What are the facts in this matter?" While the accompanying reproductions of untouched photographs in themselves tell the story, a resume of the conditions under which the tests were conducted, in addition to certain data relative to sensitivity and speed of emulsions, would seem to render doubly effective the story told by the pictures.

New Developments

New developments in carbon arc lamps providing silent operation, steadiness of burning, remote control, and freedom from costly maintenance are soon to be announced to the motion picture industry. The near future therefore has in store for the industry a light source which will meet its most exacting demands for speed, excellent photographic reproduction, economical operation and increased comfort on the set.

The writer is indebted to those who aided in the gathering of the material presented in this article, and in particular to the Research Department of National Carbon Company for the use of the illustrations and other data which originally appeared in a technical publication issued by the Company.



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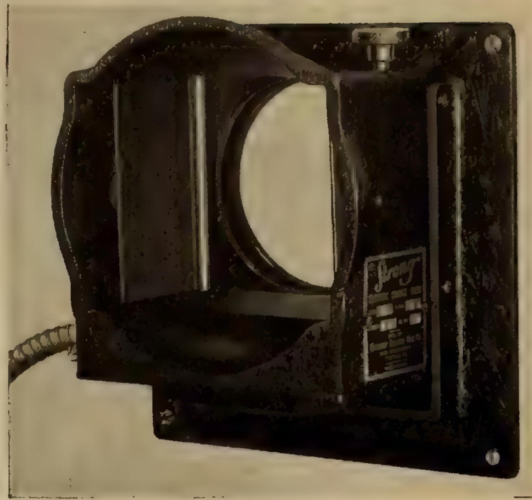
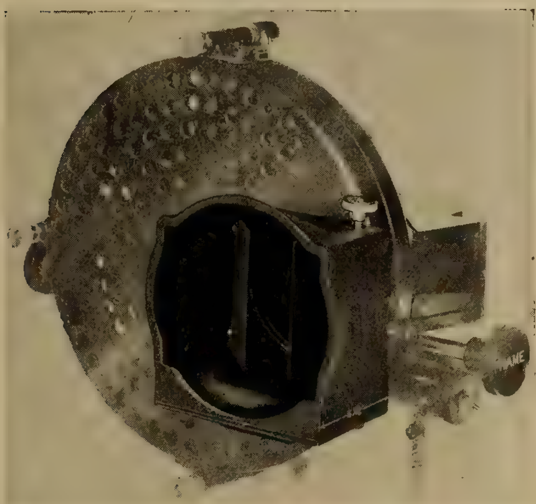
Electric Change-overs



FOR FRONT WALL MOUNTING

FOR REAR SHUTTER MOUNTING



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Here are 35 of the 542 questions that Canadian projectionists must be able to answer correctly to obtain a "grade A" card.

HOW MANY OF THESE CAN YOU ANSWER CORRECTLY?

If excessive plate current develops, what would you do?

How is amplification accomplished?

Would any kind of synchronized motor or constant speed motor do for sound projection?

Why are all the wires carrying sound or speech, lead covered and again enclosed in conduit?

What is the "gain" control, and what are its functions?

What would a low plate reading on the panel indicate?

How many tubes in a D. C. and A. C. motor control cabinet?

The photo-electric cell has a silvered lining, and one wire is connected to the lining. Is this wire positive or negative?

Does the voltage to the photo-electric cell cause a steady current flow?

What and where is the grid leak in the amplifier?

What is the function of the exciting lamp?

What is the action of (a) the plate (b) the grid (c) the filament in a vacuum tube?

What might result from placing motor generator sets and batteries in the same room?

Explain what a rectifying tube does?

What is "specific gravity"?

What are the causes of motor-boating?

Why does the needle on the disc travel from the centre of the disc to the outside?

On Vitaphone disc, is the sound recorded on the bottom of the track or groove, or is it cut into the walls of the groove?

What apparatus do the "H" batteries supply with current on W. E. and N. E. equipment?

Should all motor generator sets be grounded? If so, state why.

What is a prismatic condenser?

When using a prismatic condenser, will the condenser be closer to the aperture than if you used a plano condenser?

Can a prismatic condenser be used when showing slides?

When using a Cinephor condenser system, is accuracy in the focal distance of much importance, and why?

Can a cracked mirror or condenser be used with mazda projection? What will be the result on the screen?

What is the average amperage on (a) high intensity (b) reflector arc (c) hi-low arc?

If the voltage drops, what effect will the cutting out of resistance have?

In an electric arc circuit, what various things offer resistance to the flow of current?

What is the standard aperture size?

Why does a cracked condenser show up when projecting slides and not when projecting film?

Define the following: collector lens, plano lens, meniscus lens, converging lens, condensing lens.

What is absorption of light?

What is the optical axis?

What causes film to buckle, and what effect has this on the screen?

Which make of projector has an actual faster movement—that is, the movement of the intermittent from full rest to full rest?

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MONTHLY CHAT

OUR belief that INTERNATIONAL PROJECTIONIST is a great craft publication was confirmed at the I. A. Convention held in Columbus. One who never forgot sales for an instant in Columbus mounted the rostrum of the Convention and proceeded to define a craft publication. We were amazed to hear a certain publication which purports to serve the projectionist craft described as strictly non-partisan, wholly technical in nature and absolutely uninterested in politics and policies—not to mention personalities. I. P. wasn't mentioned by name but by implication. Not that we care a whoop, but. . . .

We can't let pass the opportunity to castigate this fellow who thought to ingratiate himself with the officers and delegates by baring his breast and showing the imprint thereon: "Safe and Sane." We can think of many arguments in support of the contention that any paper which professes to shun politics and policies, and to avoid personalities, is simply taking money from its advertisers and subscribers on a sneak-thief basis.

Probably the best argument against these whimpering publishers who seek to curry favor (and dollars), by the cry of "Safety First" was that loosed recently by Mr. G. B. Parker, editor in chief of the Scripps-Howard newspapers. Said Mr. Parker:

"There are two kinds of newspapers. Both print news. Both have editorial pages. But there the similarity ceases. For, on the editorial pages of the one kind you will find opinion. In the other you will not.

"In the first you will learn what the editor thinks, for example, about the mayor, or the administration in Washington, or the tariff, or the League of Nations, or prohibition. You may not agree with the editor. *But at least you will know where he stands.*

"From the other kind of editorial page you will find, instead of opinion, merely emasculated reading matter. Non-provocative subjects such as fresh air, spring and sunshine will occupy the columns. Occasionally the editor may go on record in behalf of good health and against disease. But he will not be so explicit as to offend. Perhaps he will oppose war, but no particular war. In one of his bolder moments he may declare against the smoke nuisance. But he will never pick on any specific chimney.

"Both kinds of newspapers are useful. But the first, in my opinion, is infinitely more useful than the second—and I am sure it is more interesting."

INTERNATIONAL PROJECTIONIST

VOLUME II NUMBER 4

JUNE, 1932

TESTING FOR 'SHORTED' FILTER CONDENSERS

A. C. Schroeder

MEMBER OF LOCAL UNION 150, LOS ANGELES, CALIFORNIA

FILTER condensers are used to filter or "smooth out" the current before it reaches the plates of the amplifier tubes. They remove the hum which would be present if the supply were to be used just as it comes from the rectifiers. They also act as a reservoir to store current and keep it in readiness so that it can be used for peak loads, which occur when the reproduction is very loud, especially on the lower frequencies.

When one of the filter condensers punctures, the show stops; or should we say when the show stops, how do we know if the trouble is a filter condenser? If the condenser shorts completely, the sound will stop at once. The reproduction will be good until the last. It will not first become distorted, nor will the volume drop gradually. In this instance there is no indication that the trouble is a condenser or something else. If the set has a plate current meter it will read zero on the faulty amplifier.

Circuit Similarity

Glancing quickly at the tubes we will see that they are lighted, showing that the trouble is not a blown fuse. At the same time we will notice that the plates of the rectifiers are red hot. An overheated plate means that there is an abnormal current flowing in the plate circuit, and a shorted filter condenser would cause such a condition.

Looking at Figure 1 we see part of the wiring diagram of the 42-A amplifier. This portion of the 43-A is practically the same as in other makes; in fact there are many amplifiers of different makes that have practically the same or very nearly the same wiring. Any amplifier and current supply can be divided as shown in Figure 2. There is one exception, and that is when batteries are used. Even then it is sometimes required that filters be used, but usually for a different purpose.

The dotted lines in Figure 1 divide the apparatus of the 42-A amplifier into three divisions. In the amplifier there is actually no division of parts, nor are they partitioned off. The dotted lines serve only to show the similarity of each section to corresponding sections in other amplifiers, as is shown in Figure 4, which is part of the wiring of one type of RCA amplifier.

Tube Current Check

While the components in any or all three of the divisions may vary in different amplifiers, they perform the same functions and are subject to the same trouble which can be diagnosed in the same manner. The filter may have one, two, or three banks of condensers; it may have one or more chokes. In some cases there is also a voltage divider, which really forms a fourth division, but this unit need not concern us here.

When no meter is present in the plate circuit we must ascertain if current is getting to the tubes by some other method, such as a voltmeter hooked from the plate to the filament terminals of the socket. If the plates of the *amplifier* tubes are red hot, it is sufficient indication that there is a flow of current and that the condensers are not shorted, for it they were, the current could not get as far as the amplifier tubes. This can be seen in Figure 1 and in Figure 4.

When one of the filter condensers is shorted, the current flows from the rectifier filament through the plus wire on the left, up to whichever condenser is shorted, then back to the negative wire, to the high voltage transformer, and so back to the plates and the filaments of the rectifier tubes. It cannot get up to the amplifier tubes.

When the condenser becomes only "partially shorted" the action is different. There is not a steady flow of current through the punctured spot, but instead the current flows intermittently. This can be seen by observing the plate current meter, which will be jumping back and forth quite rapidly. The sound will have dropped to a low level and will be very distorted, sounding fuzzy and whiskery, somewhat like a person with a very hoarse throat.

When the meter is seen to act as de-

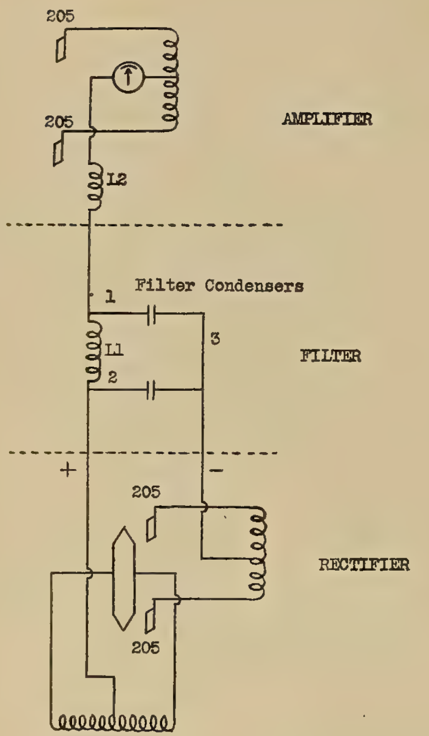


FIGURE 1

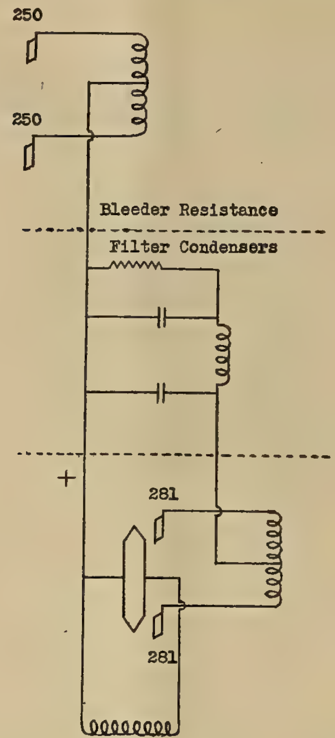


FIGURE 4

Fig. 1 shows the wiring of part of a W. E. amplifier; Fig. 4 shows the wiring of the corresponding parts of an RCA amplifier. Since there are but slight differences between these two equipments, the trouble testing and remedial measures are the same for both. The only difference in the rectifier is the positive lead: In Fig. 1 it is connected to the central tap of the filament transformer; in Fig. 4 it is connected to one end of the winding. Fig. 1 has a choke in the positive leg; in Fig. 4 this choke is in the negative leg. RCA outfits have a bleeder resistance across the output of the B supply. In the amplifier proper, W. E. has another choke and a meter in the plate circuit.

scribed in the above paragraph, it is nearly positive proof that a filter condenser is punctured; no time need be wasted looking for trouble elsewhere. We must determine which is the defective condenser.

Condenser Arrangement

Figure 3 shows the arrangement of the condensers in the 43-A amplifier, and also shows the wires connecting them to the choke, L1 in Figure 1. Wire No. 1 corresponds to the wire marked No. 1 in Figure 1. Wire No. 2 is also the same in both drawings. The negative wire, No. 3 in Figure 1, has not been included in Figure 3.

To locate the faulty condenser, break wire No. 1 where it is soldered to the first condenser, thereby cutting out all 9 condensers connected in the circuit at this point. Wire No. 2 could have been unsoldered just as well. This would have cut out the 9 condensers to the right. After the wire has been disconnected, bend it so that it does not touch anything, then turn on the amplifier to see if the trouble has been cleared. Assuming that the meter now shows normal plate current we know that the shorted condenser is in this group.

Turn off the amplifier again and break wire No. 3 at Y. Reconnect wire No. 1 and try the set again. If everything is normal, it shows that one of the condensers marked X is shorted, since these four were cut out when No. 3 wire was broken. Leave them out of the circuit and start the show. After the performance a little further testing will show just which condenser is shorted; and it should then be replaced by another and the wiring re-connected as it was in the first place.

Should the trouble still exist after No. 3 wire has been opened, then open wire No. 4, also at point Y, leaving No. 3 disconnected. Turn on the set. Supposing that this cleared the trouble, we know that one of the three condensers in the center row is bad. Solder the loose ends of Nos. 3 and 4 together, but do not solder them to the condenser. This leaves the three center condensers out of the circuit but again puts the condensers marked X back in. Start the show and replace the bad condenser immediately after the show.

If the trouble had still been present with wires 3 and 4 disconnected, it would have indicated that one of the two top condensers was bad. Leave No. 4 wire loose, reconnect No. 3 at Y and also bring No. 1 over and connect it at Y. You may have to splice a wire onto the No. 1 wire to make it reach point Y.

The procedure outlined above will locate the trouble and get the show going again in the shortest time possible. It can be done in as short a period of time as it would take to disconnect the 43-A and to connect the output of the 42-A to the 200-A panel.

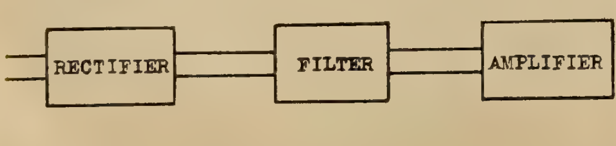
Should it happen that the "short" is still present after removing No. 1 wire at the start of the test, the trouble is in the group at the right. Reconnect wire No. 1 and then disconnect No. 5 at Z. It is not necessary to break lead No. 2, since we already are quite certain that the trouble is in this group. Now continue the test in a manner similar to that outlined for the group of condensers at the left.

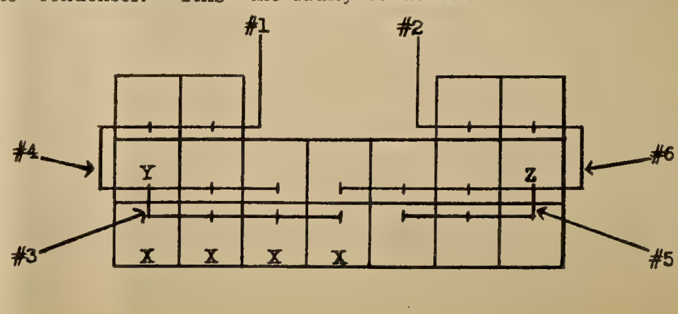
In the event that the trouble still exists after wires No. 1 and No. 2 have both been disconnected, it shows that the plus wire in Figure 1 or some of the parts connected to it are grounded. In the case of a system having three or more banks of filter condensers, they must all be disconnected before it can be decided that some other portion of the equipment is grounded.

If your amplifier is of a different type, it would be a good idea to look over the wiring to see what the most rapid method of repair would be. The wires could be marked with small price tags numbered 1, 2, 3, etc. The numbers would show the order in which the various wires should be disconnected in testing.

In Figure 3 the group to the left would be numbered 1, 2, 3. The group to the right would also be numbered 1, 2, 3. If there were a third bank of condensers, they would also be numbered starting at 1 and continuing. Of course, the numbering would be carried on beyond 3 if the wiring were such that more than three of them had to be removed to locate the faulty condenser.

Left: Figure 2
Right: Figure 3





31st I. A. CONVENTION AT COLUMBUS

Election of officers and change in permit system are salient features of meeting. No change in officers. Press reports of conflict false. Strong attack on permit system

James J. Finn

ELECTION of officers, particularly to the Presidency, which heretofore has been almost a perfunctory affair, and consideration of and action on what has come to be known as the "permit system" featured the International Alliance Convention held in Columbus, Ohio, June 6 to 9.

The Convention registered the largest number of delegates in the history of the Alliance—824 delegates from 665 local unions being accredited by the Credentials Committee. Thirty-one locals were not represented at the time the report was read.

Unfair Press Reports

If ever any convention was subjected to unfair treatment by the press—both public and trade—that convention was the I. A. gathering in Columbus. Papers within the motion picture industry have long been known to garble news relating to the I. A., and in some instances even to go out of their way to misrepresent the facts of certain happenings throughout the year. But it was some surprise to read in the public press highly colored statements of "gangster activities" in and about the Convention, the asking for police protection by Convention officials, the necessity for a "strong armed guard" about the Convention hall, and the "terrific conflict" which was being waged by opposing forces at Convention meetings. Columbus papers appeared to be the sponsors of this distortion of the facts, a portion of which was released to all newspapers over national press association wires.

It can be said at this time that none of the foregoing quotations from the public or trade press is true. While it is only natural that in an organization like the Alliance there should exist certain differences of opinion as to policies which would be reflected in vigorous verbal attack and counter-attack on the convention floor, the Columbus I. A. Convention might well serve as a model not only for labor organizations but for all large organizations having a national membership.

There were no "gangster activities," no appeals for police protection, no "strong armed guards" about the Convention hall and, as it appeared to this writer, the sessions were distinguished by a surprising air of placidity.

All Officers Re-Elected

The table accompanying this article shows that the entire pre-convention slate of officers, with one exception, was re-elected. The exception was the election of R. E. Morris as International Trustee in place of Walter S. Croft. All other office-holders were returned for another term. Contests for all offices were conducted in an eminently fair fashion and strictly on the merits of the individual contestants.

Distribution of unsigned literature attacking Sam Kaplan, President of the New York City Local 306, by his local opponents, and the appearance on the streets of Columbus of two trucks bearing placards which emphasized the salient points contained in the pamphlets, were the only disturbing notes. Obviously a New York local matter, these occurences were merely incident to and not a part of the Convention.

Local Autonomy

An important feature of the President's Report was the re-statement of the policy of the General Office to confer on local unions full authority, under the grant of local autonomy, to negotiate for terms and conditions. Another pronouncement as to policy stated that two-man sound projection shifts were deemed necessary, and any local union affecting a reduction in manpower did so at its own risk and expense.

Various other important matters were discussed in the report. Consideration for and cooperation with the stagehand was requested of projectionists' locals. Terms and conditions of the new Road Scale agreement, effective to September 1, 1933, were promulgated. The strict necessity for observance of the I. A. rule that all amplifying equipment employ a card man was stressed. Efforts to secure legislation compelling two-man sound projection shifts were commended and the recommendation made that renewed vigor go into such work.

Internal dissension in local unions was condemned as conducive to destroying the morale of the Alliance as well as of the local union involved. All local unions were urged to observe the recommendation of the Cleveland Convention that a reserve defense fund be established. High praise was paid the West Coast studio locals for their fine work in connection with the renewal of the Basic

(*Please turn to page* 11)

President
William C. Elliott
Cincinnati, Ohio

General Sec-Treas.
Fred J. Dempsey
Boston, Mass.

1st Vice-Pres.
John P. Nick
St. Louis, Missouri

2nd Vice-Pres.
William P. Covert
Toronto, Canada

3rd Vice-Pres.
William J. Harrer
Ardmore, Penna.

4th Vice-Pres.
Joseph C. Campbell
Oklahoma City, Okla.

5th Vice-Pres.
William T. Madigan
Minneapolis, Minn.

6th Vice-Pres.
Floyd M. Billingsley
San Francisco, Calif.

7th Vice-Pres.
Harland Holmden
Cleveland, Ohio

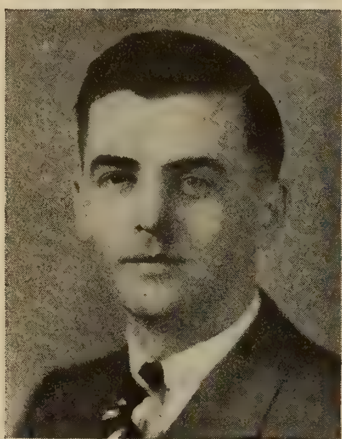
Trustees
William C. Scanlan
R. E. Morris
John McCarroll

A. F. L. Delegates
William H. Clendening
James F. Burke

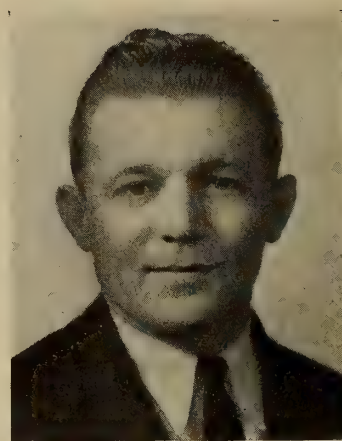
Delegate to Dominion T. and L. Congress
William B. Allen

Convention Arrangements Committee

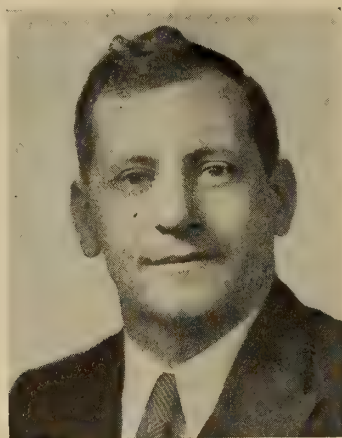
LARRY BUCK
President of Local No. 12
Advisory Chairman



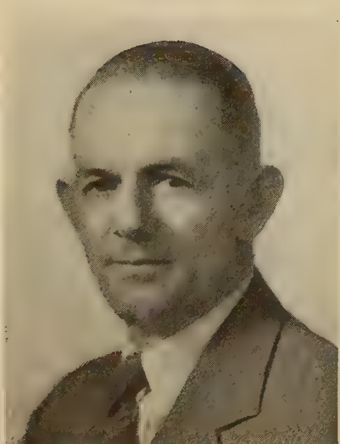
WALTER WRIGHT
Sec.-Treas. Local No. 386
Committee Secretary



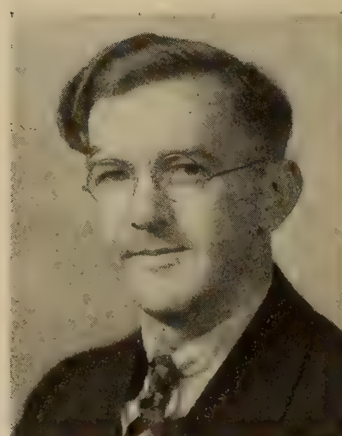
HERBERT SCHELL
Sec.-Treas. Local No. 12
Committee Treasurer



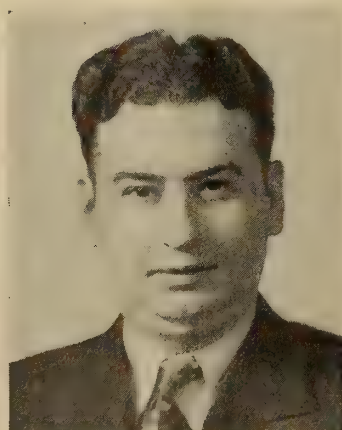
CHAS. E. PRATT
Local No. 12 Convention Chairman



GEORGE LINGO
Business Agent Local No. 12



EVERETT JAMES
Vice-President Local No. 386



HARRY COLEMAN
President Local No. 386

Studio Agreement, effective until March 14, 1934.

Prominence was given to the present status of the jurisdictional differences now existent between the I. A. and the I. B. E. W. Certain units of the Alliance, notably those on the West Coast, experience no little difficulty as a result of these differences. It was stated in the President's Report that the experience of I. A. men in show business was a valuable asset in the campaign to keep this work within the Alliance.

Responsibility of local unions to wage intensive combat against dual organizations was emphasized. It was pointed out that dual unions, if permitted to grow strong locally, would eventually reach out and seek to add more and more territory. The "Permit System" was described as the main source of supply for dual unions.

To the American Federation of Musicians went the thanks of the Alliance membership for efficient cooperation in many trying situations.

'Permit System' Action

Probably the most important work of the Convention was to effect a change in the "Permit System", so named because of the custom of some local unions to issue a working permit to men who, while not card holders, are bound by the rules of the local and must contribute to its support.

This topic was not confined to the submission of resolutions, of which there were many, but was brought right to the Convention floor and provided the basis for the sole "contest" of the sessions. Opposition to the "Permit System" was pronounced among stagehand locals and the smaller projectionist locals, the contention being that card-men applying for work at the larger locals invariably were discriminated against in favor of the nonmember permit man.

The action taken by the Convention provides that in future a per capita payment on all permit men must be made to the General Office and in the same amount as for a card-man. The effect of this action will probably be to lend impetus to the movement which has been gaining favor for sometime now, and that the establishment of "apprentice men" or "junior members" of the locals in order to distinguish the card-men.

Allegations of discrimination in New York City against the card man from outside the city in favor of the man working under permit were made by J. Brennan of Local 1. A reply to this charge was made by Sam Kaplan, who as President of Local 306 has conducted the work of providing a supply of men for sound jobs. Kaplan contended that the "Permit System" was the result of necessity and not of choice. Further, he contended, stagehands now were displaying interest in projection work that should have been apparent when appeals for added manpower were made four or more years ago.

Another interesting phase of the Convention was the reinstatement of Charles C. Shay as a member of Local 1, New York City. Shay, a former President of the Alliance, was stricken from the Alliance rolls at the Cincinnati Convention in 1924. Messrs. Dunn and Donnelly, expelled members of Minneapolis Local 13, were also reinstated in the Alliance.

Education Ignored

Anyone who expected that the Columbus Convention would interest itself in the educational activities of the various local unions was doomed to disappointment. Not one resolution was offered, not one speech was made in favor of official I. A. approval to the furtherance of a national educational society among projectionist locals. Moreover, not one word was uttered bearing on the desirability of the various locals participating in any educational activities for their own members. One technical session was held throughout the entire Convention week, and to St. Louis Local Union 143 must go the credit for providing the quarters and aiding in the holding of this single session. But then, St. Louis always did have superior projectionists.

The desire of the friends of educational for a pronouncement by the Convention in favor of such activities is readily understandable. It is understood by the friends of education that any movement looking toward the establishment of a national educational society must necessarily have the approval of the Alliance—without which it would be useless to make much effort toward the establishment of such a society.

The Convention did go on record, however, as favoring the repeal of the Eighteenth Amendment to the Constitution of the U. S.

Splendid Arrangements

The members of the two Columbus local unions are deserving of the highest praise for the manner in which they made arrangements and conducted Convention matters in general—and this despite their very meager resources. Hard work and lots of it went into the 31st Convention arrangements, and locals 12 and 386 have earned the appreciation of the entire Alliance for the way they handled the job. INTERNATIONAL PROJECTIONIST is glad of the opportunity to reproduce elsewhere in this issue a page of photos of the men who did all this work.

Opening day was marked by the usual number of addresses by distinguished visitors, notable among which were the talks given by Governor White of Ohio and Rabbi Jacob Tarshish. The latter made a stirring appeal for a wider distribution of the country's wealth, particularly among the laboring class which creates the wealth, and discussed the relationship existing between the Church and Labor.

Special W. C. Representative

In future the West Coast studio locals will have the benefit of an International Representative who will handle studio work exclusively, according to a resolution adopted by the Convention. The studio situation has proved a severe strain on the International President, and it was deemed better to have one representative devote his entire time to this work. Appointment has not yet been made to this post.

A list of the delegates accredited to the Convention by the Credentials Committee is appended hereto:

Local	City and State	Delegates
1	New York, N. Y.	John F. Casey
		Al. Gardner
		Harold Williams
		Edward P. Gately
		Joseph L. Magnolia
		Harry A. Sheeran
		John C. McDowell
		Louis Yeager
		James J. Brennan
		Sam Goldfarb
2	Chicago, Ill.	Richard J. Green
		John McCloskey
		Arthur Morrison
		James T. Ryan
		Mark Morrison
		Larry Cassidy
		Frank C. Olsen
		George E. Browne
3	Pittsburgh, Pa.	Robert Ellison
		James N. McGrath, Jr.
4	Brooklyn, N. Y.	Linford Risley
		Richard Walsh
		Thomas Murtha
		Bernard Ryan
5	Cincinnati, Ohio	Edmund Callahan
		Andy Bolan
6	St. Louis, Mo.	C. O. Newlin
		William Nick
		William Wiggins
7	Denver, Colo.	George W. Brayfield
		Frank G. Lemaster
8	Philadelphia, Pa.	Michael J. Sweeney
		William Mooney
		George W. Peterson
		John J. Shanahan
9	Syracuse, N. Y.	Joseph Flaherty
10	Buffalo, N. Y.	William Burke
		Edward Burke
11	Boston, Mass.	James H. Duffy
		James J. O'Brien
		James Hayes
		Samuel E. Horton
		William F. O'Brien
12	Columbus, Ohio	Herbert Schell
		Larry Buck
13	Minneapolis, Minn.	Roy Weir
		Fred Ebert
14	Albany, N. Y.	John B. Sample
15	Seattle, Wash.	Earnest A. Clark
16	San Francisco, Calif.	Joseph Roberts
		George Ward
17	Louisville, Ky.	Phil Greenberg
		Mike Joseph
18	Milwaukee, Wis.	R. A. Scheffing
		Jack Worner
19	Baltimore, Md.	David E. Crow
		Jerome E. Buckingham
20	St. Paul, Minn.	Joseph H. McHugh
21	Newark, N. J.	Arthur F. Post
		Thomas V. Green
22	Washington, D. C.	Daniel V. Peck
		George Donaldson
23	Providence, R. I.	Joseph A. Prew
		Fred W. Newcomb
24	Toledo, Ohio	John J. Russell
25	Rochester, N. Y.	Ben Connolley
		Michael J. Mungovan
26	Grand Rapids, Mich.	L. W. Leland
27	Cleveland, Ohio	Manus McCaffery
		John Fitzgerald
28	Portland, Ore.	Don Dumas
		Charles M. Campbell
29	Troy, N. Y.	James Lemke
30	Indianapolis, Ind.	Carl Tangeman
		D. R. Barneclo
31	Kansas City, Mo.	Felix D. Snow
		Harry W. Moody

Local	City and State	Delegates
32	Duluth, Minn	J. P. Shanahan
33	Los Angeles, Calif	J. J. Riley
		E. H. Neff
		S. B. Newman
		H. B. Gregg
		Carl G. Cooper
34	Springfield, Ohio	Peter Gaughan
35	Saginaw, Mich	Alex Wineki
36	Lowell, Mass	
37	Hollywood, Calif	Lew C. G. Blix
		James E. Shaw
		Leland S. Armstrong
		Harry Hodgins
		Joseph M. Donnelly
		Edward J. Heim
		Charles J. Ferguson
		Raymond C. Morris
38	Detroit, Mich	Alexander K. Dear
		E. Clyde Adler
		Joseph T. Finnigan
39	New Orleans, La	E. J. Mather
		James Dempsey
40	Sioux City, Iowa	Frank J. Colbert
41	Atlanta, Ga	Cliff Clower
42	Omaha, Nebr	Harry H. Bushey
43	St. Joseph, Mo	Walter Hay
44	Paterson, N. J	John J. Lawler
45	Newburgh, N. Y	John LaMont
		James D. Tweed
46	Nashville, Tenn	Walter A. Craddock
47	Pueblo, Colo	Dan Rush
48	Akron, Ohio	Frank M. Gruber
49	Terre Haute, Ind	Carl E. Braun
50	Sacramento, Calif	William Deegan
51	Houston, Tex	Harry L. Spencer
52	New York, N. Y	John Flaherty
		Arthur Gerson
		John W. Murphy
		S. J. Scoppa
		Charles J. Maguire
53	Springfield, Mass	Michael J. Casey
		Daniel A. Haggerty
54	Binghamton, N. Y	Floyd C. Merrill
55	Roanoke, Va	E. B. Brown
56	Montreal, Canada	F. W. Cooper
57	Fall River, Mass	William A. Dillon
58	Toronto, Canada	Alfred E. Jackson
59	Jersey City, N. J	James A. Walsh
		John J. Walsh
60	Pensacola, Fla	Henry Brown
61	Canton, Ohio	Charles Schumacher
62	Colorado Spgs., Colo	Louis Ziman
63	Winnipeg, Man., Can	Norman W. Code
64	Wheeling, W. Va	Frank J. Carney
		Theodore Bowers
65	Galveston, Tex	Ed. Pye
66	Dayton, Ohio	Joseph W. Boulie
67	Des Moines, Iowa	Sidney A. Searles
68	Scranton, Pa	Lawrence J. Campbell
69	Memphis, Tenn	David Rosenthal
70	Youngstown, Ohio	E. J. Tinney
71	Newark, Ohio	Richard A. Thompson
72	Norfolk, Va	James W. Simmons
73	Lynn, Mass	Harold Hunt
74	New Haven, Conn	John S. O'Connell
		Herman G. Hegewald
75	Peoria Pekin, Ill	Fred G. McLinden
76	San Antonio, Tex	Eddie Galan
77	Atlantic City, N. J	William H. Clendening
78	Birmingham, Ala	E. J. Lother
79	Massillon, Ohio	Ira E. Dietz
80	Elizabeth, N. J	Golie B. Hagin
81	Tacoma, Wash	Roscoe C. Swindells
82	Wilkes Barre, Pa	John McGeady
83	North Adams, Mass	James Henderson
84	Hartford, Conn	R. K. Lewis
		H. F. Sweet
85	Davenport, Ia. Moline, Ill	Glade W. Norney
86	Fitchburg, Mass	George Lester Greene
87	Richmond, Va	W. D. Anderson
88	Waterbury, Conn	John M. Fitzgerald
89	Holyoke, Mass	James Kennedy
90	Stockton, Calif	Henry DeWitt Colestock
91	Boise City, Idaho	W. E. J. Rose
92	Montgomery, Ala	Lilliard T. Farris
93	Spokane, Wash	Chester R. Cook
94	Butte, Mont	Joe Levesey
95	Ottawa, Canada	Romeo R. Marcil
96	Worcester, Mass	John C. Ryan
		John E. Hauser
97	Reading, Pa	Frank Porter
98	Harrisburg, Pa	William S. McKay, Jr.
99	Salt Lake City, Utah	Oscar Phirman
100	Parkersburg, W. Va	Charles W. Miller
101	Newcastle, Pa	P. F. Miller
102	Evansville, Ind	Edward J. Moskowitz
103	Dubuque, Iowa	Thomas S. Smith
104	Zanesville, Ohio	John E. Fluke
105	London, Canada	P. W. Rehder
106	Marion, Ind	Clarence V. Covalt
107	Oakland, Calif	William Daul
		Frank C. Casey
108	Geneva, N. Y	Gerald L. Fowler
109	Bridgeport, Conn	William Belden
110	Chicago, Ill	Thos. J. Reynolds
		Thos. E. Maloy
		Hal Johnstone
		Benj. Hannaberg
		Jack Wolfberg
		Arthur Lyons
		John C. Mulvaney

(*Please turn to page* 15)

Convention Sidelights

• Red Dowling of Easton, Penna., had the reddest hair of any Convention man. His partner, S. A. Seifert, had the lowest golf score—indoors!

• Sands, of Los Angeles L.U. 150, didn't have a chance to ballyhoo California sunshine. The first two days of the Convention had "official" mercury readings of 95 and 100.

• Some of the West Coast camermen brought along their midget cameras, and some mighty fine pictures resulted—views of the buildings, of the parks, of Ohio State University (and of the St. Louis projectionists' headquarters).

• Incidentally, the palm for the best all-around open house and a superior brand of hospitality must go to St. Louis L.U. 143. Starting well in advance of the Convention, the 143 boys kept everlastingly at it to the end. A fine bunch. Messrs. Kleintopf and Stone gave advice at the critical moments.

• In the same breath we hasten to unload the news that it was in the 143 quarters that the only technical (that is, strictly technical), session of the Convention was held. Dr. Brown, of ERPI; P. A. McGuire, of the P.A.C., and one or two lesser lights expounded before an awed group of novitiates. Oscar Kleintopf, m.c.

• Hurd and Klaffki of 659 (W.C. cameramen), didn't seem to be having a good time. Evidently too busy running from Conference No. 38 to No. 39.

• Thad Barrows, President of 182 (Boston), and chief factotem of the P.A.C., was a visitor in Columbus while the Convention was in progress.

• Billingsley, San Francisco L.U. 162, appointed an I.A. v.p. last year, had his first taste of running a committee assignment. Everybody agreed he made a smooth job of it and bit his initials into the I. A.

• The 4th District threw so many meetings that Lawrence Katz decided to remain in bed and hold them in his room.

• The 306 (N. Y. City) delegation put on the mystery act. Between Convention sessions nobody saw much of them—although it is safe to say that plenty of people heard from them.

• They still continue to read the official list of delegates. This job requires about 2 hours flat. Somebody ought to move that the printed list be thrown at the delegate and a request made for corrections, if any.

• Those first day's speeches were simply terrible. Rabbi Tarshish had rather an effective mode of delivery, else even his remarks would have rated zero. Dick Greene, of L.U. 2, made a "hello" talk that should be officially adopted as a model.

• Yager, of Salt Lake City L.U. 250, had more dope on various interesting angles of running a labor organization in the face of stiff opposition than have any three Internationals in the country. Good stuff, too.

• Jim Shaughnessy and Arthur Martens, of 650 (Westchester County, N. Y.), shadowed each other continually. They didn't get a chance to put in a plug for Westchester real estate. These two men have done a whale of a job with 650; and they added to their reps in Columbus.

• Joe Engle, prexy of 640 (Long Island), gulped down a ton of information without once committing himself. He probably got the most out of the Convention.

• When that I.A. bunch finally cleared out of the Neil House the management might just as well have taken a few sticks of dynamite and blown up what was left.

• The smart boys who checked into the Deshler-Wallick were probably more sensible than the fellows at the Neil—yet they practically missed the Convention.

• The oratory on the Convention floor anent the "permit system" was confined to the representatives from one town. New York hogged the show in this respect.

• These newspaper reports about "gunmen" and "armed guards" were made to look foolish when on election day the contestants for office were seen disporting themselves at the rear of the hall, One expected them to play leap-frog next or call for a set of quoits.

• Bill Kunzmann and Don MacRae were very much in evidence. Kunzmann was so busy crabbing about the merits of National carbons that several times he was left at the table talking to himself—and with the checks, of course.

• Harland Holmden and Victor Welman were the Cleveland L.U. 160 big-wigs present—probably offering up thanks that it wasn't Cleveland that had to do the honors for the mob.

• A Kansas delegate who came to the Convention suffering from an infected leg was suddenly rushed to the hospital for an emergency operation. The news was passed about the Convention hall on election day (with not more than a quarter of the delegates present), and $400 popped into a hat so fast that one would think it grew there. These I.A. guys are given to long speeches—but they always pay off!

• It was a close race for the best-dressed man prize between Madigan of Minneapolis and Maloy of Chicago. Decision reserved until both contestants submit to an inspection in pajamas.

• So many members of Pittsburgh L.U. 171 were in attendance that one expected Mellon to be nominated. Brown, Freeman, Shawkey, Dietrich, and Criswell were spotted at various times.

• Kalkoff of Milwaukee L.U. 164 had a speech prepared advocating the return of Schlitz beer. He tore up the speech after one tour of inspection.

MOTION PICTURES IN RELIEF

Probably the most important contributions to the art of three-dimensional motion pictures have been made by Dr. H. E. Ives of the Bell Telephone Laboratories. Recently Dr. Ives compiled a gargantuan paper which set forth in detail the results of several years of work in the art. Outside of filling space, there appears to be no good reason why such detail should appear herein; and it is considered that the following concise article, prepared at, and appearing herein through the courtesy of, Bell Laboratories will best serve the interests of our readers.—Editor

THE projection of motion pictures in relief, visible to a group of observers occupying a wide range of positions with respect to the screen, but demanding no special spectacles or other apparatus at the eyes, has been experimentally realized in the Bell Telephone Laboratories according to disclosures made recently before the National Academy of Sciences by Dr. H. E. Ives.

This extension of Dr. Ives' three-dimensional work from still pictures to motion does not employ the conventional celluloid film, but harks back to a toy which the older generation will remember in which a series of pictures are mounted on a revolving wheel. Although the action lasts only a couple of seconds before it repeats, the spectator sees a true motion picture which has all the depth and roundness of a stereoscope view. The cumbersome wheel is thus far essential because of the high degree of accuracy of position needed to project the picture on a special screen, and serves to emphasize Dr. Ives' caution that *commerical application seems remote.*

Basic Principles

To understand his latest development, one must first recall that seeing anything stereoscopically means that one sees it with each eye from a different viewpoint. The brain then interprets the slight differences in the two retinal images as meaning that the scene has depth. In the familiar parlor stereoscope, each eye sees a different photograph, the pair having been taken initially through cameras about three inches apart.

If motion pictures are taken in a similar manner, and viewed in such a way that each eye sees only the picture meant for it, there will be an illusion of depth in the picture. So far, the successful methods of doing this have involved the projection of the pictures alternately or in two complementary colors for the two eyes, and either a rotating shutter in front of each person or a pair of spectacles, colored red and green, to prevent the eyes seeing any but the appropriate picture. Dr. Ives' developments break away from using anything on or near the beholder; apparatus ends at the screen.

The Screen

The screen is one of the basic elements of the system. It is made up of vertical celluloid rods, about a quarter-inch wide, and ground to accurate cylindrical curvature at front and rear. The curvature of the front face of each rod is such that rays of light starting from an elemental segment of the rear face are refracted in a narrow parallel beam toward the observer.

By impressing successive elements of the picture, in the form of vertical lines, on the back of successive rods, the whole picture is built up for the observer.

The picture on each successive element of a rod is refracted in a slightly different direction, so that the two eyes of each observer will see different pictures, as built up by two different series of picture elements. Since these two pictures are appropriate for left and right eyes respectively, a stereoscopic image is seen.

To place the picture elements on the rear surface of the rods, the latter are given a frosted finish, and a lantern slide is projected on them. Making this slide is, however, a difficult proposition.

Plurality of Views

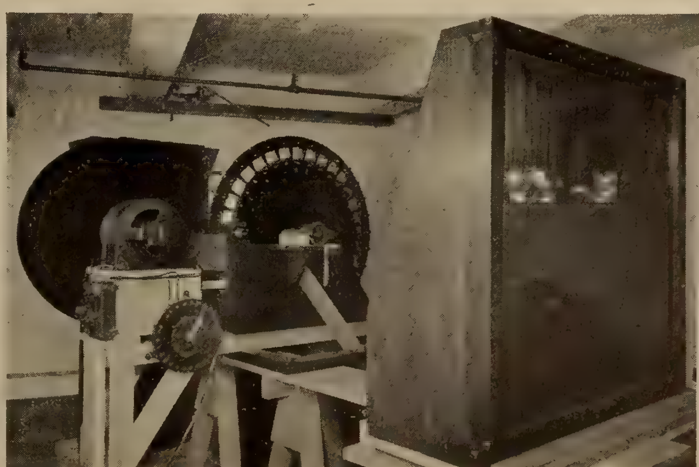
Since the ultimate spectators, if there be any considerable number of them, will probably be spread over an angle of thirty degrees on each side of the auditorium, or a total angle of sixty degrees, the original picture has to be made from a series of view points extending over an arc of sixty degrees around the object.

One way to do this would be to take a series of pictures, either successively by a single camera, or simultaneously by a group of cameras arranged along the arc of a circle and pointing toward the object at that circle's center. These schemes are, however, cumbersome and expensive.

It is desirable to make the pictures with apparatus employing a single photographic exposure. In order to accomplish this, Dr. Ives had recourse to a concave mirror four feet in diameter. Light rays from the object placed at the focus of the mirror would be reflected back to a focus at their origin, were it not for a semi-transparent plane mirror which reflects them off at right angles. At the new focus of the mirror which has been thus established, a group of images of the object are formed, one for every possible viewpoint around the concave mirror.

These images are superposed, but it is possible to disentangle them, since the rays which form each one differ in the direction from which they approach the focal plane. The discrimination between images is effected by interposing a glass screen of fine concave grooves. This breaks up each image into a series of lines spaced regularly across a photographic plate.

In the space between adjacent strips of one view appears, in order, a strip from each other view, so that if one eye of the observer could see but one family of strips, it would perceive the picture



Projector and screen developed by Dr. Ives for showing motion pictures in relief. The wheel carries 32 successive pictures which make up Dr. Ives' brief 'movie'. Behind it in the other wheel is the aperture which admits a flash of light as each picture reaches the projection point

'SOUND SCHOOL' MAIL FRAUD IMPRISONS TWO

Federal Court sentences F. A. Jewell to 3 years and L. A. Smith to 2 years in Atlanta prison. Many I. A. victims. International Projectionist exposed trio

James J. Finn

IN a courtroom packed with former "pupils" (victims), Fred A. Jewell, conductor of a "projectionist sound school" in Easton, Penna., and two co-workers, Lester A. Smith and Eric E. Mackey, were sentenced on June 20 in New York by Federal Judge Patterson for using the mails to defraud.

Jewell was sentenced to 3 years and Smith to 2 years in Atlanta Penitentiary. Mackey also received a 2-year sentence, operation of which was suspended during good behavior. In addition, fines of $1,000 each were levied, but suspended, against the Electrical Sound Institute, parent company; the National Sound Service Bureau, Inc., and the Photo-Electric Research Laboratory, Inc.

The activities of Jewell were first brought to the attention of the writer three years ago by Easton Local Union 203, to the members of which credit is due for uncovering his fraudulent intentions. Since that time the writer has hammered away consistently against the activities of Jewell and many others of his kind—with Jewell's trail finally leading him to the penitentiary.

'Students' Victimized

During these three years Jewell victimized thousands of "students" who were induced to pay exorbitant "tuition rates" for a meagre amount of information, much of which was incorrect. So many Alliance members were duped by Jewell that former President William F. Canavana, at the instigation of the writer, issued a general ban against him throughout the Alliance. Offers of high-salaried positions upon "qualification" invariably were included in all the Jewell advertising matter.

At one time Jewell offered the writer a "cut" on all students secured for his school through his sponsorship and backing. This offer being declined in what Jewell termed was "abusive language," the writer was threatened with a suit for defamation of character.

Finding the organized projectionist field closed to his school, Jewell established headquarters in New York and became the head of three companies: Electrical Sound Institute (the "school"); National Sound Service Bureau (the job outlet for "qualified students"), and the Photo-Electric Research Laboratory—the latter being sponsor for the "truly amazing" invention named the "Photo-Graver" which was reputed to make line cuts by a photo-electric process. This invention was proven a fake by the writer who cited references dated 1884 bearing on a similar process.

The Chain

During the life of this three-company set-up, more than 2,000 men, many of them practically destitute, enrolled for the course. The idea was sold to the victims in a most highly colored fashion, the promoters holding out that the Photo-Graver would soon establish a world monopoly and net huge returns to all concerned. More than 40 branches were established in as many cities all over the country and high-pressure salesmen were engaged to secure students on a 50 per cent commission basis.

A sample of the type of promotion literature put out by this combine is appended to this article and is indicative of the tactics employed by this group. To make their offer doubly attractive, assurances were given of a tie-up with a major sound equipment manufacturer which would enable placement of hundreds of "graduates" of the school.

Other Schools Operating

Thus ends the story of Mr. Jewell and his associates. But the story of sound

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as viewed from one point on the concave mirror as though seen through a grille of thin vertical wires. Precisely this effect is achieved by making a lantern slide from the plate and projecting it upon the back of the rod screen described in an earlier paragraph.

Two Separate Views

It will now be understood why each eye of the ultimate beholder sees a different picture, the difference being that of beholding the original scene from two viewpoints a few inches apart. Stereoscope vision is thus attained, and those who have seen Dr. Ives' laboratory set-up have reported that the effect of depth is well marked.

To make a motion picture, it is necessary to project successively varying pictures on the screen. It will be appreciated that the minute accuracy necessary to register a fine structure of lines exactly upon a series of rods can only be secured by glass plates firmly but adjustably mounted on a rigid moving support.

Dr. Ives therefore affixed his series of 32 transparencies to a rotating disc so that each plate could be separately orientated in the optical system. Since the pictures do not halt in the projection gate, it was necessary to flash a light through each as it reached the projection point.

All in all, the size and delicacy of the apparatus emphasize Dr. Ives' caution as to the *remoteness of commercial application* while the lifelike quality of the moving image is convincing evidence that another milestone has been passed in the development of motion picture relief.

The projected relief pictures as viewed from three directions

Sample of 'Bait' Used by Jewell Associates

There are going to be more ten and fifteen and twenty-five thousand—yes—and even fifty thousand dollar a year jobs with our associated corporations, than there are warts on a frog's er - rear end, and some of you fellows who are reading this now, are going to be in these jobs. All of you who are reading it have a chance for them.

We have been and are going to continue to grow faster than any other corporation in America. We are going to get so doggone big and have so damn much money that the United States Government is going to have to build new mints, and we are going to have to open up our own banks just to have a place to keep the money—the ones they have now are not big enough.

No matter how wild a dreamer you are, or how vivid your imagination is, or how many shots in the arm you can take, you can't realize what a chance you have here.

Our big jobs are going to be filled from the ranks of the men holding the little ones now, and if you are anything more than the dumbest guy in the world, you want to get sold on that idea and then go out and sell the world on it—for the world is our meat and we are sitting on top of it and we have got it by the tail. So get your coat off—give us every ounce of "guts," brains and energy that you have, and if you can find any place that you can use them that will bring you bigger, quicker returns, I am a cock-eyed hump-backed Chinaman. So let's go—let's hit that old ball—let's triple the pace and boy, oh boy, we will start believing in Santa Claus again—we will begin to pity Rockefeller's poverty and you'll know that God is in his old Heaven and there are more blessings there than there are brickbats in hell—so altogether now—

HEADS UP — CHIN OUT
FORWARD HO— WE'RE OFF!!

projection schools is not ended. Even now there are sound projection schools in operation all over the country. The "courses" offered embrace a wide range of prices and instruction—from "10 Easy Lessons for $25" to courses of six months and more for $150.

Many such schools operate within the law, but their services are pretty much of the same unsatisfactory pattern. Instruction sponsored by the Local Union has been demonstrated to afford the best service and greatest protection to members of the organized craft.

INTERNATIONAL PROJECTIONIST derives particular satisfaction from the Jewell conviction, inasmuch as it exclusively brought to the attention of the craft the fraudulent activities of this three-company combine and lent its services in opposing its operations.

CONVENTION DELEGATES

(*Continued from page* 12)

Local	City and State	Delegates
111	Lawrence, Mass.	Maurice A. Fitzgerald
112	Oklahoma City, Okla.	John B. Campbell
113	Erie, Pa.	Terrence Cunningham
114	Portland, Me.	Frank J. Jackman
115	Jacksonville, Fla.	Ralph M. Toy
116	Trenton, N. J.	Stephen J. Connelly
117	Bellingham, Wash.	Albert W. Bostrom
118	Vancouver, Canada	Harry Pearson
119	Auburn, N. Y.	James J. Gallery
120	Pittston, Pa.	Norman J. Saunders
121	Niagara Falls, N. Y.	William H. Colquhoun
122	San Diego, Calif.	Carl B. Callahan
123	East Liverpool, Ohio	William Hemphill
124	Joliet, Ill.	William G. Brown
125	Bay City, Mich.	Walter R. Richardson
126	Fort Worth, Texas	Linton W. Burke
127	Dallas, Tex.	H. W. Floyd
128	Utica, N. Y.	Donald R. Rood
129	Hamilton, Canada	Earl Jack
130	Altoona, Pa.	Charles E. Brunner
131	New Bedford, Mass.	
132	Warren, Ohio	Clarence W. Otto
133	Hammond, Ind.	William J. Schulte
134	San Jose, Calif.	John F. Faull
135	Sedalia, Mo.	Earl E. McMillin
136	Hamilton, Ohio	Neal Johnson
137	Springfield, Mo.	Joe Roberts
138	Springfield, Ill.	William A. Schafer
139	Schenectady, N. Y.	Harry A. Engle
140	Chattanooga, Tenn.	R. H. Mills
141	LaCrosse, Wisc.	Paul Spettel
142	Mobile, Ala.	R. E. Morris
143	St. Louis, Mo.	Oscar Kleintopf
		A. L. Stone
144	Memphis, Tenn.	William H. Holland
145	Lakewood, N. J.	Richard S. Harrison
146	Fort Wayne, Ind.	Bud Berger
147	East St. Louis, Ill.	Clyde A. Weston
148	Logansport, Ind.	D. H. DeHaven
149	Brockton, Mass.	John H. Kenny
150	Los Angeles, Calif.	F. A. Sawyer
		T. W. Armentrout
		R. L. Haywood
		C. C. Harden
		M. J. Sands
		E. W. Apperson
151	Lincoln, Nebr.	Malcolm F. Dewey
152	Hazelton, Pa.	George A. Gicking
153	El Paso, Tex.	Homer F. Bowington
154	Seattle, Wash.	James McNabb
		Charles Crickmore
155	Piqua, Ohio	Joel W. Hixson
156	Danville, Ill.	Georger Hamer
157	Allentown, Pa.	Stanley M. Moyer
158	Fresno, Calif.	E. J. Knobloch
159	Portland, Ore.	J. S. Haughey
		J. T. Moore
160	Cleveland, Ohio	Victor A. Welman
		Jacob Fried
		Charles S. Bullock
161	McKeesport, Pa.	Louis McMillian
162	San Francisco, Calif.	Anthony L. Noriega
		James Luther
163	Louisville, Ky.	Robert L. Hulett
		Edward W. Klapheke
164	Milwaukee, Wis.	Glen C. Kalkhoff
		Elmer A. Klase
165	Cincinnati, Ohio	Harry Schwartz
		William Hahn

(*Continued on page* 26)

'RAIN' IS FIRST W.E. WIDE RANGE RECORDING

"Rain," which is now being produced at the West Coast by United Artists, is the first talking picture to use the new Western Electric Wide Range Recording. The advantage of this new recording system in extending the frequency range of sounds that can be recorded and reproduced are specially evident in the exterior scenes of this story which are being filmed at Catalina Island.

During the steady downpour of rain, an essential part of the story's atmosphere, the moving coil microphone demonstrated its superiority, and the ability of wide range to record sounds with greater naturalness and increased freedom from distortion has facilitated the task of obtaining faithful recording in several difficult shots of the production, particularly in the constant dripping of the rain, and in the recording of sound in a narrow corridor scene where a floor ceiling and two walls made intelligible audition difficult. In both instances excellent results have been obtained.

Wide Range Advantages

The essential changes in Wide Range Recording consists in the use of moving coil microphones to the exclusion of all other types and in the introduction of three simple electrical networks which result in flattening the over-all frequency characteristics from the output of the microphone to the input of the scanning slit in reproducing. The highest order of fidelity is obtained up to approximately 8,000 cycles, an increase at the high end of more than half an octave over previous recording limits.

P. A. C. Welcomes Hausner in Miami

STANISLAUS HAUSNER, Polish-American, and member of Local 306 of the International Alliance, who was rescued in mid-Atlantic after his plane failed him on a projected flight to Warsaw, arrived in Miami, Florida, on June 23. Despite a late arrival, thousands of Miamians were at City Yacht Basin and the Olympia Theatre to greet him. At the Olympia representatives of various organizations extended their greetings and felicitations and the Gold Cross of Merit was presented. The welcoming ceremonies, participated in by a representative of Governor Doyle E. Carlton, Mayor R. B. Gautier, Thaddeus Zazulinski, First Secretary of the Polish Legation, and others, were held at the Municipal Airport.

Speaking briefly from the Olympia stage, Hausner, while declining to tell of the days on the floating plane, said he was in the air 28 hours before his plane failed and estimated he covered 2,890 miles.

W. S. Roberts, regional Vice-President of the Projection Advisory Council, read from the stage the following telegram to Hausner:

ON BEHALF OF WILLIAM C. ELLIOTT PRESIDENT OF INTERNATIONAL ALLIANCE OF THEATRICAL STAGE EMPLOYEES AND MOTION PICTURE MACHINE OPERATORS OF THE UNITED STATES AND CANADA AND THAD. C. BARROWS PRESIDENT OF THE PROJECTION ADVISORY COUNCIL EXTEND CORDIAL WELCOME HOME AND EXPRESS ADMIRATION FOR YOUR ENTERPRISE COURAGE AND ABILITY WHICH REFLECTS CREDIT ON ALL PROJECTIONISTS WE KNOW YOU WILL TRY AGAIN AND ARE CONFIDENT YOU WILL SUCCEED

P. A. McGUIRE,
Executive Vice-President, Projection Advisory Council.

PRACTICAL PROBLEMS OF THE PROJECTIONIST

THE accompanying article is based on the report of the Projection Practice Committee to the recent Spring Meeting of the S.M.P.E. The report is divided into four sections one of which, "Theatre Problems of the Release Print," was presented as a separate paper at the Theatre Operation Sessions of the meeting. The sections are:

1. A description of a method of testing the output level of several projectors during the performance for the purpose of maintainiing them in an equalized condition.

2. A description of a method of checking the continuity of the speech circuits of individual speaker units during the performance. Such an arrangement can also be used for equalizing the sound volume before each performance.

3. A study of "Theatre Problems of the Release Print" contained in a paper that deals with:

Processing of Film	**Buckled Film**
Dense Positive Prints	**Uniform Volume Level**
Film Cutting for Change-over Purposes	**The S.R.P.**

4. The Committee's comments on projection problems and on the importance of competent supervision of projection, dealing with the maintenance of quality of performance and the effecting of economies in operation. Committee members:

HARRY RUBIN, *Chairman*

J. O. Baker	**W. C. Kunzmann**
Thad Barrows	**R. H. McCullough**
G. C. Edwards	**P. A. McGuire**
Sam Glauber	**Rudolph Miehling**
J. H. Goldberg	**F. H. Richardson**
Chauncey Greene	**Max Ruben**
Herbert Griffin	**P. T. Sheridan**
Jesse J. Hopkins	**L. M. Townsend**

NO method has heretofore been made available which would permit the testing of the idle projector for output level while performance was being conducted on a second projector. In the event that a difference in output level between projectors developed, it was necessary to wait until the end of the day's run before checking and correcting trouble of this nature. Meanwhile, the projectionist was obliged to compensate for inequality of sound level between projectors each time a change-over was made. As a result of this procedure, faulty control of sound volume occurred in a great many cases.

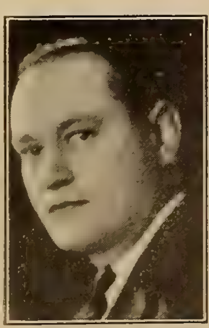
The Committee realizes that some means should be provided which would permit this inequality of volume output to be corrected immediately after being discovered, and would also enable a check to be made at any time that the existence of this trouble is suspected. A brief description of a device for this purpose follows:

Output Level Indicator

The general wiring of the output level indicator circuit is illustrated in Figure 1, which shows a jack *A* bridged across the output of one projector *A*, while a jack *B* is bridged across projector *B*. This arrangement can be extended to include three or more projectors. Attached to the output indicator is a plug to be inserted in the several jacks and also a plug to be connected to 110-volt A. C. circuit.

Figure 2 gives the details of wiring of a vacuum tube voltmeter and an associated amplifier. At the left is shown the power transformer and rectifier tube and filter.

For use with the output indicator, the Committee recommends that several lengths of test film carrying 1,000-cycle, 90 per cent modulated sound track be furnished to each projection room as a part of the regular equipment, to be kept on hand at all times. These lengths can conveniently be attached to the beginnings or the ends of the reels or run separately on the idle projector, thus affording a check on the output whenever desired during the performance.



Harry Rubin

Speech Circuit Check

With regard to the second question mentioned above, a method is desired of determining the continuity of the speech circuit of each individual horn receiver during the performance. The speech coil in certain types of loudspeakers is a delicate piece of equipment and is subject to occasional breaking down; and when this occurs, the distribution of sound in the theatre may be noticeably affected. This condition requires immediate correction.

A device, such as is shown in Figure 3, may be used to provide the projectionist with a ready means of determining which of several loudspeakers is inoperative owing to a defective speech coil. Each speech coil circuit is provided with a jack placed in one side of the line between the output of the horn panel and the loudspeakers backstage. This permits plugging an A. C. milliameter in series with each speaker. A zero reading on the meter indicates an open circuit.

This equipment can also be used to check the equalization of projectors by plugging the A. C. milliameter into one of the speech coil circuits, and running the 1,000-cycle test film in each projector while noting the meter deflection.

Screen Visibility

There are several factors which advversely affect screen and sound results. At the present time the projectionist has a far less critical view of the screen than anyone else in the theatre. He should be provided with facilities to enable him to see the picture as plainly as the patrons in favorable locations so that he can discover and remedy visual defects and not be dependent upon observations made by others. The projectionist should be able to hear the reproduced sound as plainly as anyone in the audience. Assistance in the solution of the problem of improving the projectionist's reception of reproduced sound in the theatre is urgently requested. Any practical ideas along this line will be gratefully received and carefully studied by the Committee.

These problems naturally present tech-

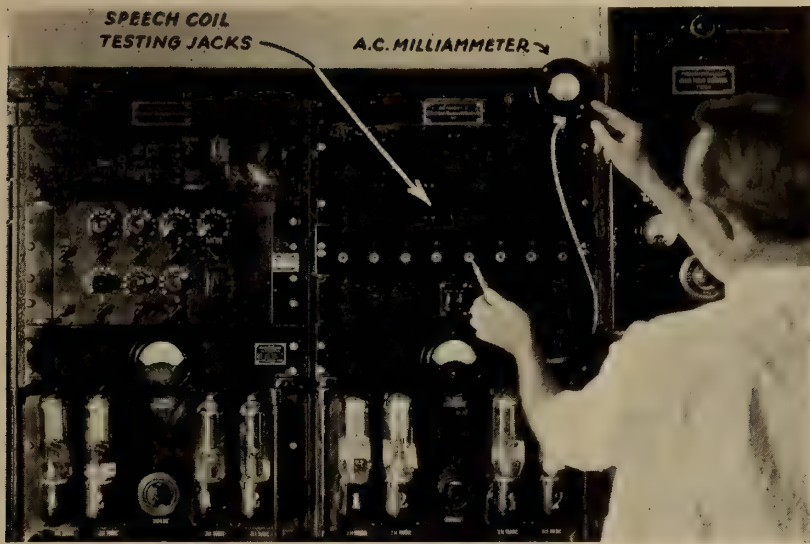


Figure 3

nical and commercial difficulties but are sufficiently important to merit intensive study for the purpose of improving present conditions, which impose a severe handicap upon projectionists in the presentation of sound pictures. In the interim, before high quality sound can be provided in the projection room, volume indicating instruments should be furnished as a partial substitute.

The Committee has received the cooperation of one manufacturer, who is attempting to improve the visibility of the screen from the projection room. As a temporary measure, the Committee advocates the use of a high-powered glass so as to bring the screen apparently within twenty feet of the projection room.

Projection Supervision

The Committee wishes at this time to stress particularly the need of competent supervision of projection. This need has existed since the first pictures were shown, but its importance has been underestimated.

Competent supervision is even more vital to the industry under present conditions. There has never been a time when the "sales resistance" of the public has been as great as at the present, or a time when its critical faculties were so highly developed. It is doubly important, under such circumstances, that entertainment be presented upon the screens of the theatres under the most favorable conditions and in a flawless manner, as the projected picture and sound are the closest contacts the public has with the industry. This is best accomplished through supervision by qualified men who have familiarized themselves with the many projection problems through years of theatre contacts.

Supervision includes instructions to projectionists as to the proper presentation of the productions; the proper handling of the film in order to reduce damage and degree of wear of prints and thus to extend their useful life; the institution of working routines to provide for smoothest performance; the provision of instructions relating to the uses of equipment to obtain various projection effects for the purpose of enhancing the entertainment value of the performance; provision for periodic inspection of projection equipment, including the checking for proper adjustments, so as to prevent film damage; making correction of possible sources of trouble before breakdown occurs with consequent possible interruption of show; and the training of projectionists to acquaint them with methods of handling emergency situations, instructions for quickly locating any source of trouble and the methods of making repairs.

Supervisor's Advantages

The supervisor is in close contact with practical projection problems in the theatres and is able to seek out remedies for the correction of difficulties encountered, and to initiate or aid in the development of new appliances to this end or to accomplish improved or more economical operation. He is also able to pass upon the necessity of making repairs, and is often able to point out a more economical method of making them.

He is familiar with the methods of testing under practical operating conditions the many appliances offered to the theatres. He is frequently able to suggest methods of improving such devices, making them more valuable to the theatre.

As an example of the need of supervision, a recent court decision ordered an exhibitor to pay more than $200 damages to a film exchange for injuring a print while in the possession of the theatre. The amount awarded was based upon the actual footage that was scratched at the rate of 3¾c per foot. It is quite probable that such a decision might lead to similar actions against exhibitors in the future.

Even when exhibitors are *not* ordered to make direct payment to exchanges, the industry is obliged to absorb the cost of all film damaged through mishandling, most of which could be prevented.

The Committee directs attention to the fact that many large companies have in the past few years enormously improved projection and sound results in their theatres by providing competent supervision. Supervision of projection provides the only means by which economy and high quality results can be effected.

Lack of proper supervision in projection has already accounted for a substantial loss of money to the industry, and this waste will continue until the importance of competent supervision is realized.

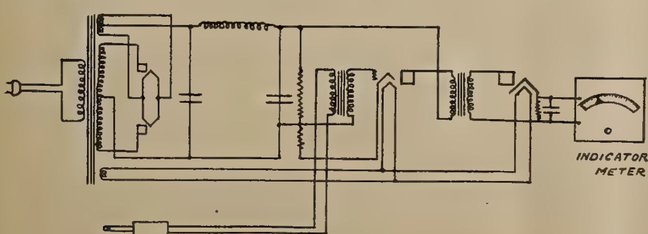


FIGURE 2
Output indicator for use on A.C. power supplies

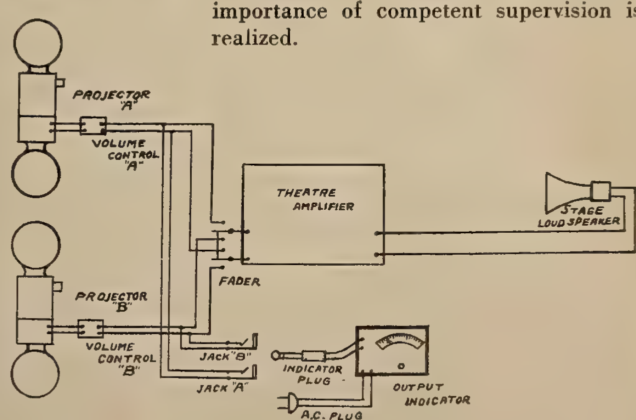


FIGURE 1
Outline drawing of theatre equipment, showing the use of an output indicator for equalizing the outputs of two or more projectors.

THEATRE PROBLEMS OF THE RELEASE PRINT

This paper was prepared by the Projection Practice Committee of the S.M.P.E. and was originally intended to form a portion of the Committee's report to the Spring Convention. It was deemed advisable, however, to present this particular section at the special Release Print Session in order that it might have the benefit of consideration and discussion along with related problems of the production and distribution branches of the industry.

THE problems of the release print as they affect the theatre, although comparatively few, are nevertheless of the utmost importance in attaining a high degree of excellence in screen results.

The Projection Practice Committee has, in its previous reports, called attention to the shortcomings of the various methods of treating finished positive prints to facilitate transit of film through the projector under ordinary projection conditions. The Committee has also directed attention to the problems of film buckling, film mutilation, the responsibility of the projectionist in handling prints and the responsibility of the theatre manager in reporting faulty prints.

Film Processing

In respect to the problem of processing film, the Committee has found that some of the methods employed were not entirely satisfactory, inasmuch as in some instances emulsion continued to accumulate on projector parts during the early showings of the film, and in other instances the preparations used in the processing methods accumulated in the projector and caused faulty sound.

From practical experience and tests, the Projection Practice Committee has found it *undesirable to apply even minute amounts of wax or oil preparations to the film*, and has also found that the use of unprocessed film is undesirable. The Committee advises against the foregoing methods; but is in favor of a process whereby the emulsion is hardened sufficiently to avoid the difficulties encountered in early projection of film. Such a process has now been in use for the past several months by certain producers and has been found entirely satisfactory.

Buckled Film

Buckling film prevents proper visual and sound presentation. This problem was a serious one until very recently when complaints of this nature became less frequent. Apparently some improvement has been made in the film or in the laboratory methods which accounts for the elimination of these difficulties. The Committee recommends that a constant check be maintained on this point in order that the present improved product may be continued.

Prints are sometimes received in theatres which are printed too densely for best results. This may have been caused by the density of the print having been judged in a studio where it was projected on the screen, the illumination of which was in excess of that which can be obtained in the average theatre. On the other hand, prints are occasionally received which are too light in density, causing a lack of proper contrast.

The Projection Practice Committee is at the present time taking readings of illumination screens in various theatres and it is hoped that a recommended level for screen illumination can thus be arrived at and the studios requested to determine best print density under such conditions.

Occasionally, it is impossible to make proper visual and sound change-over between reels, due to the fact that the sound essential to the action continues up to the last frame of the outgoing reel and begins with the first frame of the incoming reel. Due to the displacement of the sound track in relation to the corresponding picture, such cutting of film results in loss of or confusion in sound.

The Committee recommends that, in determining the beginnings and endings of reels, a point be selected for change-over which will be satisfactory from a *visual and sound* standpoint, and further recommends that suitable leeway be allowed so that sound essential to action should not occur at the extreme end or the beginning of a reel.

Uniform Volume Level

At the present time theatres frequently receive film with widely varying level of recorded sound within single reels, a greater variation between reels of the same picture and still wider variation between subjects. Under such conditions it is difficult to maintain the proper sound level in the theatres. Since the theatres are continually striving to maintain their several projectors and their sound equipment in an equalized condition for presentation of sound pictures at the proper level, it is highly desirable that the producers and laboratories cooperate in providing film which is free from wide variations in recorded sound level which are not intentional.

The objects of the Standard Release Print are to reduce film mutilation, which occurred through the punching of film by individual projectionists for change-over purposes, and also to permit accurate change-overs between reels. To be properly effective, it is necessary, first, that the indicating marks for motor starting and film change-over be accurately placed, both with respect to end of reel and with respect to individual picture frame; second, the indicating marks should be sufficiently conspicuous to be conveniently noticed by projectionists.

This second point is made for the reason that in a good many instances a black spot without the surrounding white circles appears upon a dark background. This seriously reduces the visibility of the indicating marks when viewed from the projection room and thus contributes to uncertainty of the projectionists in starting motor and in making film change-over. It would be better to have a white circle surrounding the black spot.

The Committee feels that only by rendering the indicating marks reliable in one hundred per cent of the cases can the element of uncertainty be removed and the punching of film by individual projectionists be eliminated.

The Committee is of the opinion that the new reduced size of the indicating marks is an improvement over the original size, and where this present size of black mark is applied on a light background, the reduction in size has not affected the visibility.

[NOTE: One suggestion as to a means for overcoming this lack of visibility is to apply a narrow concentric ring of opaque material around each indicating mark on the negative film. This would result in a narrow white circle around each black dot on the positive print, which indication should be visible against a dark background. This ring might be stamped on with the same operation as that now performed in punching the negative.]

Projection Practice Committee,
HARRY RUBIN, Chairman.

EDITOR'S NOTE: *Another improvement in the S.R.P. has been suggested by several readers of* INTERNATIONAL PROJECTIONIST. *This has to do with the placing of the signal dot in such a way that it appears on a character in the picture who is moving from right to left in the scene. When the signal dot is so positioned, the eyes of the projectionist instinctively follow the movement of the character and ignore the dot—often with serious trouble ensuing. It has been suggested that when the proper positioning of the dot would place it directly upon a character in motion, it be moved either higher or lower so as to appear on the stationary set background.*

A TRIBUTE WELL EARNED

JUST how important is the work of the Projection Practice Committee to the S. M. P. E. and to the industry generally is evidenced by the accompanying letter received from Dr. A. N. Goldsmith, President of the Society. Even more significant is the fact that a large majority of the members of this Committee are Alliance men, and their fine work for the Society cannot help but win prestige for the entire Alliance within the Society and throughout the industry.

It is pretty generally agreed that the work of the Projection Practice Committee within the past year represents the finest contribution on practical projection work made to Society records in the past ten years. Dr. Goldsmith's letter itself bears out the truth of this estimate.

It is to be regretted, however, that so few realize the splendid work done by projectionist members of the S. M. P. E. and only an extremely limited number have the faintest understanding of the sacrifices made by members of this Committee. A prophet is not without honor save in his own country; and a hard-working projectionist member of the S. M. P. E. Projection Practice Committee gains recognition and earns the thanks of all save those members of his own craft, most of whom apparently are too busy with other things to care much about the matter.

The high regard of Dr. Goldsmith for the work of this particular Committee is evidenced by the fact that he was a regular attendant at all of its meetings.

The Committee meetings usually were called to order about 7:30 P. M., and it was frequently after midnight before adjournment. Throughout the sessions various subjects were brought up for consideration and debate and no action was taken or decision made which was to be incorporated in the report without painstaking thought and full discussion. The notes of each meeting were carefully gone over by Jesse Hopkins, Committee secretary, so that typewritten reports of each session could be sent out to each member prior to the drafting of a final report.

It should be borne in mind that this work by projectionist members was *in addition* to their regular daily work. No extra compensation was received for this arduous toil and no cheering multitudes were expected to be on hand at the reading of the final report. These men worked for their craft and for every member thereof. How many projectionists ever took the time to think about the sacrifices of these men whose efforts meant better work and increased prestige? Not many, it is safe to say.

The work and responsibility of this Committee was assumed almost entirely by Harry Rubin, the Chairman, and Jesse Hopkins, the Secretary. This is not said in any sense to discredit the other members of the Committee, all of whom would be glad to substantiate this statement.

Projectionists derive great benefit from the work of the men who comprise this Committee and other progressive projectionists who are interested in the advancement of their craft. It is to be sincerely hoped that the projectionists who are prevented from joining in organization activities of an educational nature will at least be willing to give others credit for what they accomplish absolutely without any financial compensation and frequently without any reward. Fortunately for the craft, there are such men who are willing to make the sacrifices which result in the collection of accurate technical information which may be passed along to all members of the craft.

INTERNATIONAL PROJECTIONIST stands squarely back of the idea that the difference between an "operator" and a projectionist lies solely in the difference between the indifferent individual and the man who is willing to do his bit toward raising the general level of projection work. We repeat: anything that adds prestige to the craft as a whole is of benefit to the individual member thereof. Only by being ever ready to contribute to the general craft welfare can the projectionist hope to gain recognition from fair-minded executives.

No commercial organization, no matter how powerful it may become, can continue indefinitely to lower the quality of its merchandise and increase the price. We say with equal positiveness that projectionists, as a whole, must make the same effort to maintain the quality of their work. The value of organization is freely acknowledged, but every craftsman must endeavor to render a service to those who employ him which will reflect credit upon the organziation to which he belongs.

These projectionist members of the Projection Practice Committee, through their unselfishness, through their sense of responsibility to the organization to which they belong and in their desire to raise the standards of their profession and help their fellow-craftsmen—these men, who sought neither money nor cheers, should serve as a shining example of the type of craftsman wanted in the projection field.

No scroll will be struck off to pay honor to these men for their work, no extra coins will jingle in their pockets as a result thereof. But—they will feel amply repaid, we are sure, if the general level of projection work has been raised through their efforts. After all, if not this, then for what else did they have to work?

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June 2nd, 1932.

Mr. James J. Finn,
James J. Finn Publishing Corp.,
1 West 47th St.,
New York City.

Dear Mr. Finn:

Permit me to compliment you on the excellent material contained in the May, 1932 issue of "International Projectionist" relative to the activities of the Society of Motion Picture Engineers. I particularly appreciated the comments made on page 5 under the heading of "Monthly Chat". As I said on the occasion of the Convention, the Society is proud of its projectionist membership, regards this group of members as a most valuable asset, and leans heavily on them for information and practical guidance in matters involving their craft.

The Projection Practice Committee is one of the most active Committees of the Society and has, as you have correctly pointed out, contributed substantially to the advancement of the art. I hope that the Society may continue to enjoy the help of the projectionists so that the engineers may be kept well informed relative to practical problems of theatre operation.

Sincerely yours,

Alfred N. Goldsmith

President

RECTIFIER POWER SUPPLY FOR SOUND SYSTEMS

B. F. W. Heyer and W. F. Bonner

Rectifier power supply units, to replace storage batteries, are now available, through ERPI, for all Western Electric sound systems. First public announcement of this new unit was made at the S.M.P.E. Spring meeting through the medium of the accompanying paper.

THE low voltage D.C. power required for operation of sound reproducing equipment varies with the equipment but, generally speaking, in a typical theatre installation it is necessary to have a 12-volt source supplying approximately 8 amperes for the 2 exciter lamps, 4½ to 12 amperes for the loudspeaker fields, and in those systems having amplifiers using filament type cathodes, filament current must be supplied. Some systems require, in addition, several amperes for the pilot lights, relays and announcing system.

Thus, from 10 to 25 amperes at approximately 12 volts represents the low voltage power demand of the usual sound system which must be supplied from rectifier power units when applied to present installations as battery replacements and to new installations as a primary source of low voltage current.

The first major consideration in the design of a rectifier power supply unit is the supression of the A.C. component to rectified current. To arrive at the ripple voltage requirements, the following factors must be considered:

Amplifier Gain

The gain of the amplifiers must be considered because the hum introduced in the photoelectric cell and amplifier from excessive ripple voltage in the exciter lamp will be increased in the same proportion as the reproduced speech. In making the tests to determine the allowable ripple voltage in the exciter lamp circuit, it will be noticed that the presence of film in the projector reduces the hum originating in the exciter lamp. However, the hum introduced from the exciter lamp will always be fixed with reference to the sound introduced by the sound track on the film, and for that reason it is preferable when determining ripple voltage limits for the exciter lamp to make these tests without film in the aperture.

In systems having amplifier tubes with filament type cathodes which must be supplied from the power unit, the hum introduced in the photoelectric cell amplifier will be constant but will be increased with the reproduced signal in direct proportion. In addition, where filament current is used for C bias, the ripple voltage in the filament supply will directly excite the grids. This necessitates a filament current extremely free from ripple, if annoying hum is to be kept out of the system.

The hum introduced in an amplifier* being supplied with filament current from the power unit where the amplifier is located in the system after the volume control, will be introduced in the system as a constant level for all gain settings.

In determining, therefore, whether a certain ripple voltage in the exciter lamp and the amplifier filament circuits is satisfactory, it is advisable to increase the gain in the system until the loudspeaker is being energized at a maximum, with no film in the aperture.

Having established a satisfactory hum to signal level ratio by the original test on one loudspeaker, this permissible voltage can then be applied to the system, regardless of the number of speakers operating; although the volume of the sound will be increased to meet the requirements of a larger auditorium, the amplitude of the hum on the system will not increase appreciably with relation to the signal.

Response of the System at 120 Cycles

Should the sound system have a relatively low response at 120 cycles, it must be taken into consideration at the time the power unit is being designed, as, otherwise, future modifications, either in the amplifiers or loudspeakers which will improve the response, may also raise the hum to an objectionable level.

The effect of system noise introduced by the photo-electric cell and amplifier tubes was very considerably masked with the earlier types of film recording, as the noise inherent in the recording itself was relatively high. This ground noise also has a masking effect on hum introduced in the system through the ripple voltage from a power supply unit. This must be considered at the time the tests are made to decide the ripple voltage limits, for in the event that these amplifier and photo-electric cell noises are subsequently reduced through improvements in the sys-

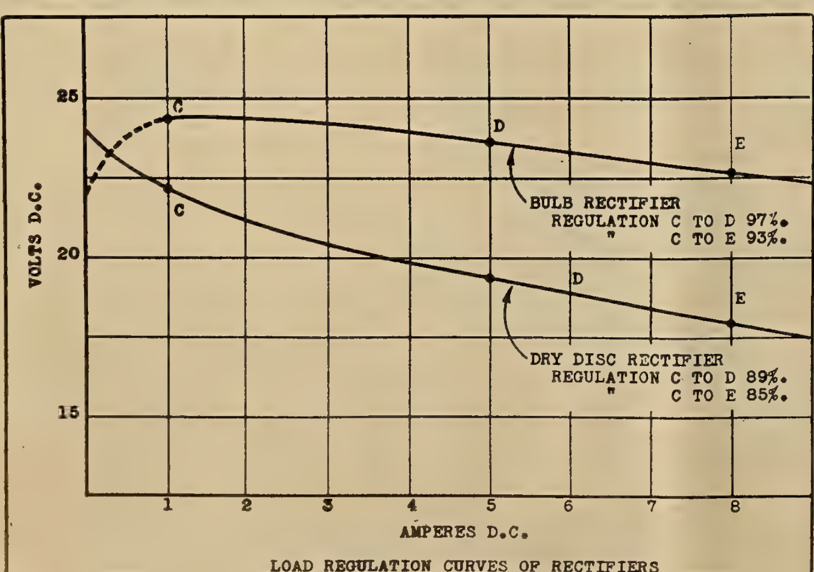


Figure 1

* Referred to as "System Amplifier" throughout this article.

FIGURE 2

Output voltage control resistances of a rectifier power supply unit

tem, a hum previously completely masked may become annoying during the quiet sequences of the film.

Accumulative Effect of Ripple Voltage in System

The accumulative effect of ripple voltage from the components of the system must also be considered in the design of a power unit. For example, while a hum originating in the exciter lamp, amplifier or loudspeaker may be below audibility when considered separately, the hum in each of these components may be additive, and therefore may reach an undesirable value. This necessitates keeping the allowable ripple voltage for each circuit below that actually necessary so the hum in the system will still be within the noise to signal ratio considered satisfactory for operation on present-day sound systems.

The circuits operating the signal lights and relays in sound systems designed for battery operation are usually so wired that unfiltered direct current cannot be applied to them without introducing hum in the system. For that reason it has been found necessary to filter this circuit not only to prevent inductive interference with the sound system but also to prevent chatter of relay armatures.

Load Regulation

The second major design consideration is load regulation. By load regulation of a rectifier power supply unit is meant the effect on voltage supplied to any part of the sound system of load changes made either purposely or accidentally on other parts of the system operating from the same power supply source. This problem is practically non-existent with a lead storage battery since the terminal voltage variations over the current range required in sound reproducing equipment is so slight that it can be neglected.

However, both rectifier and filter circuits have certain regulation characteristics giving rise to voltage variations under load changes that must be given careful consideration. For example, in actual operation the exciter lamp is frequently turned on or off, thus changing the load on the system by approximately 4 amperes. When this takes place, it must not interfere with the satisfactory operation of the other parts of the system operating from the same power supply.

To determine the permissible limits of such load changes, it is necessary to consider the circuits of all the sound systems with which rectifier power supply is to be used. In some cases, minor changes in switching or circuits must be made to adapt the system to the load regulation characteristics of the power supply unit. Where such modifications are deemed inadvisable from an engineering, operating, or economic standpoint, the power unit must be designed to meet the requirements of the sound system. Unless a careful analysis is first made of all systems with which the power unit is to be used, it is impossible to design a unit that can safely be put in the field with the assurance that it will give the service expected.

To determine load regulation characteristics of a rectifier power supply unit, it is necessary first to determine the load regulation of the rectifier to be used, and then that of the filter required. Fig. 1 shows load regulation curves of the two main types of rectifiers, bulb and dry disc. These curves were made with the rectifiers connected for full-wave rectification.

A dry disc rectifier, due to its regulation characteristics, is not satisfactory for parallel operation of filters. Separate rectifiers and filters must be provided for each load circuit in order to obtain the required regulation. An alternative method can be employed, this consisting of relays and substitute load resistances.

Due to the inherently good regulation characteristics of the bulb rectifier, in practically all cases it is not necessary to compensate for the possibility of disconnecting certain portions of the load from the filters, although in a few instances it may be desirable to use a compensating resistance and a relay.

Output Voltage

The third major design consideration is that of output voltage. There are naturally many more factors entering into the manufacture of a rectifier power supply unit which may result in a wider variation in output voltage than obtains with lead storage batteries. With proper design, these voltage variations may be restricted to narrower limits than a battery of proper ampere-hour capacity, and as a consequence, require less attention from the projectionist for rheostat readjustment.

Fig. 2 shows the output voltage control resistances of a rectifier power supply unit having five separate filter circuits. Readily adjustable tapped resistances are used rather than rheostats as proper adjustment may be made at the time of installation to bring the output voltage within the range of the equipment rheostats.

The resistance of the filter system should be kept as low as possible, as otherwise the change in D.C. resistance of the filters due to heating during operation may be sufficient to cause a variation in output voltage beyond the range of the equipment rheostats and will also necessitate constant readjustment while in operation. With proper design, readjustment need be made only once or twice during the first two hours and possibly one more adjustment when the temperature reaches a constant value.

Load Regulation Requirements of a Typical System

Satisfactory load voltage regulation must be maintained to keep the correct volume level and to prevent burn-outs of vacuum tube filaments, overloading or distortion in the amplifiers.

The most important point in the circuit for proper maintenance of the voltage is that at the exciter lamp. Any current change in the lamp, however slight, is greatly amplified in its effect on the volume level of the system. The

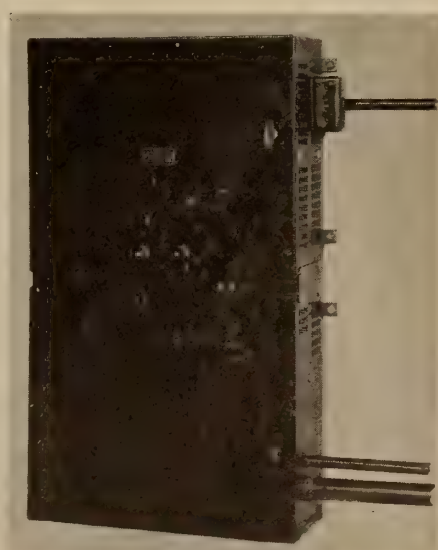


FIGURE 5

Showing a two-projector power unit mounted on a wall

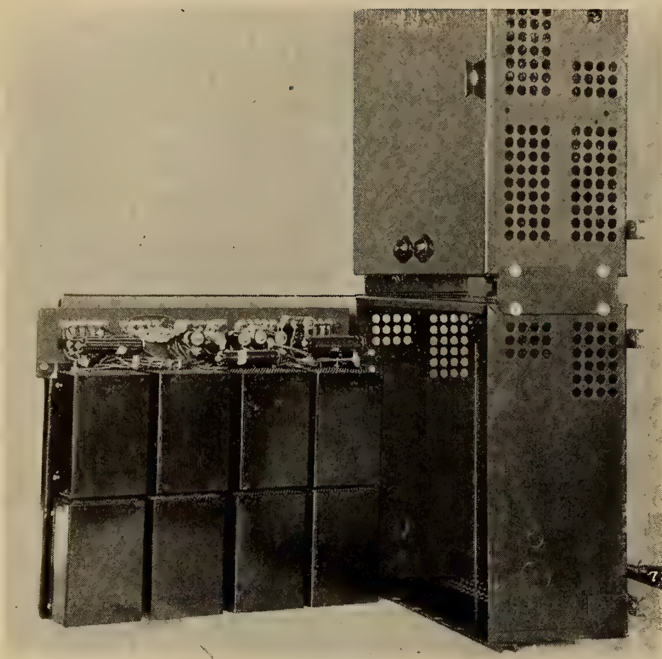


FIGURE 3
View of lower section showing shielding

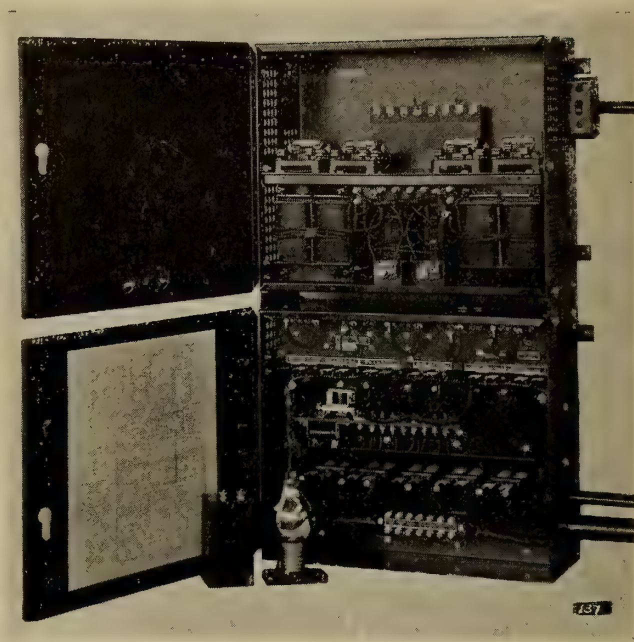


FIGURE 4
Inside view of 2-projector power unit showing reactances and relay

voltage on the amplifier filaments, while of less importance, must be maintained well within 5 per cent of normal voltage.

Shielding

In a grouping of rectifiers and filters in one case it is necessary to carefully consider inductive effects of the reactances, both internal and external to the power unit. Obviously when any filter circuit in a power unit is connected or disconnected, a powerful field is created around the reactances. This may cause a disturbance either in other filter circuits, or directly in the sound system amplifier circuits. To eliminate interference all resistances must be shielded.

Fig. 3 shows a method used in mounting and shielding the resistance of the amplifier filament and signal current supply circuits, which eliminated all troublesome inductive effects.

The sound system will also be completely free from clicks or disturbing noises when the output circuits of the filters are correctly wired for satisfactorily low rectifier hum.

Installation

The power unit shown has been designed for wall mounting and is of minimum practical width and depth to make best advantage of the space available in or near the projection room. The large unit is divided into upper and lower sections to facilitate mounting and handling within the theatre.

As it is desirable to have the leads as short as possible, the best locations for the power unit is in the projection room. To this end all rectifier tubes are protected against physical contact and the outside temperatures of the cases meet the requirements for equipment in the room.

It is often possible and practical when making replacement installations to locate the power units in the former location of the batteries or the battery charging panel, using the existing wires and adding only those wires necessitated by the modification. Where possible, it is desirable to locate the units in the projection room, as the equipment is then centralized and under constant observation of the projectionist, as well as leaving all space outside of the room available for other purposes.

Combining Units

To facilitate installation and to minimize wall space required, it is desirable to combine a number of rectifier and filter circuits. Figs. 4 and 5 show a unit which includes circuits for two p.e.c. amplifiers with their exciting lamps, one system amplifier, three loudspeaking receivers, and current for auxiliary circuits.

PHILOSOPHIC BACKGROUND OF UNIONS

Sumner H. Slichter, Ph.D.

QUITE a large number of labor unions—the machinists' union, the electricians', the sheet metal workers', the boilermakers', the blacksmiths', the carmen's, the maintenance-of-way men's, the printing pressmen's, the photo-engravers', the textile workers', and the clothing workers'—have demonstrated not only their willingness to cooperate with managements in solving problems of operation, but their ability to make an important contribution.

Needless to say, these organizations are not willing to cooperate on any terms and conditions. Naturally and properly they put the interests of their members ahead of the interests of the stockholders for whom they work. The fact remains, however, that ingenious and far-sighted leaders on both sides who possess the will to cooperate have succeeded in discovering a basis on which management and labor can join to promote the interests which they have in common.

Cooperation or Bitter Class Struggle

Whether or not the dominant note in American industrial relations during the next generation will be union-management cooperation or bitter class struggle depends upon the leaders in the industries which are now unorganized—iron and steel, automobile, electrical equipment, meat packing, rubber, telephone, petroleum, agricultural implements, and others—persist in their uncompromising opposition to the efforts of wage earners to join the other organized groups in the community.

My prediction is that the policy of union-management cooperation will prevail, because I am confident that there is enough industrial statesmanship among American business men for them to realize that the policy of suppressing organization is the policy of sitting on the safety valve.

NEW SYNCROFILM PORTABLE SOUND PROJECTOR ANNOUNCED BY WEBER

THE Syncrofilm Portable Sound Projector was developed for professional and non-professional use for all purposes where permanent equipment cannot be maintained. It is the result of many years of development work by engineers thoroughly qualified in the field of projection and film sound reproducing equipment, and is manufactured by Weber Machine Corp., of Rochester, well known in the professional sound field.

The Syncrofilm Projector was designed not only for the dual purpose of sound reproduction and projection performance of the highest class, but for simplicity in set-up, operation and transportation. It is a complete unit, incorporating all of the most desirable features known in both sound and projection.

Attachments Unsatisfactory

Through the rapid and unforseen growth of sound pictures, many manufacturers were forced to face the problem of re-designing and re-tooling their silent projectors or engineering an attachment to fit their product. Those familiar with sound reproduction will understand the difficulty of designing satisfactory attachments of this nature. Practically all of the silent type of portable projectors were designed for operation at 60 ft. per minute; while sound film requires a constant speed of 90 ft. per minute. It is necessary to maintain this speed to close limits without waver or fluctuation.

Syncrofilm engineers were in the fortunate position that they did not need to consider large inventories of parts and equipment which may be made obsolete through any radical changes in design. They were enabled to make a new start, thus availing themselves of all the latest developments in the art of projection and sound. That they have taken advantage of this opportunity to its full extent will be quickly realized upon inspection of this new equipment.

All Professional Features

The new Syncrofilm Portable Sound Projector incorporates many of the most desirable standard features embodied in professional projectors, and, at the same time, lightness and portability has been included. It is truly portable in every sense of the word, weighing only 60 lbs. The newest developments of Mazda projection lamps have been adopted. The lamps used in Syncrofilm projectors equal the results obtained with carbon arcs, without the difficulty to maintain or the skill required to operate. The projection lenses used are of very high grade, manufactured by one of the leading manufacturers of projection lens systems. They are also interchangeable with standard lens systems, used in theatre projection equipment.

Latest Sound System

The sound and amplification system proves that advantage was taken of the extensive experience Weber had in the building of sound systems. The optical system is designed to reproduce the highest frequencies recorded, every unit being set and tested to cut a minimum of 8,000 cycles.

The Syncrofilm all electric amplifier is one of the latest developments in the art, combining all of the advantages of the new tubes and circuits available, making it possible to reproduce faithfully the latest full-range recordings. Syncrofilm is a high grade sound projector, up to date in every way, producing clear, steady pictures, and faithful reproduction of sound. Better projectors are not made, regardless of price, is the Syncrofilm claim.

NOTES *from the* SUPPLY FIELD

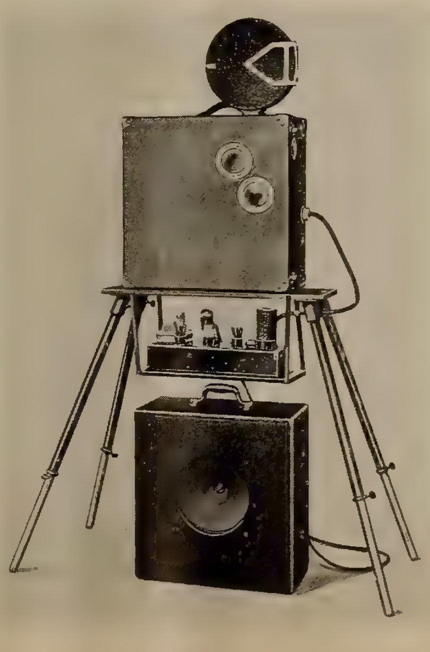
★

SPECIFICATIONS

Case
Suitcase type, cast aluminum, size 8½" x 21" x 21". Black crackle finish.

Weight
Projector complete, 60 pounds.

Frame
Aluminum alloy machine moulded castings.



Intermittent
Hardened and ground, star wheel and cam, same size and design as used in popular theatre projectors, easily adjusted to take up wear.

Light
Mazda pre-focused base, 500-, 750-, or 1,000-watt, 500-watt furnished with standard euipment.

Projection Lenses
4" Focal length of same type used in theatre equipment. Other sizes can be furnished, if desired.

Reflector
Ground and polished optical glass, heat-resistance coated.

Condensor System
Two 3" dia. ground and polished plano convex.

Motor
1/20 h.p., 110-volt, 60-cycle constant speed, with highest grade precision balanced armature.

Bearing
Special alloy bearing bronze.

Shutter
Two-point rear shutter designed as partial fan to ventilate gate and aperture plate.

Ventilation
Fan attached to motor shaft, designed to furnish a large volume of air to cool projection lamp.

Drives
Round belts, which facilitates a slow even start and prevents excessive shock on mechanism and film.

Sound Mechanism
Is an integral part of the projector, designed to drive and operate in conjunction with projector mechanism.

Parts
Has fewer parts than any sound projector developed up to the present time.

Exciter Lamp
Standard 8½-volt, 4 ampere, bayonet base.

P. E. C.
Standard U. X. Base, caesium type, of highest quality obtainable.

Amplifier
Push-pull pentode type incorporating latest and best features. Tubes: one 280, one 224, one 227 and two 247.

Speaker
Dynamic Cone Type, perfectly matched with amplifier.

Current
110-volt, 60-cycle A.C.

Aperture
Recent standard for sound prints.

Strippers
All driven sprockets are provided with strippers.

Framing
Framing lever is easily accessible at back of case, and is positive in action.

Lubrication
A centralized lubrication system is provided so that all parts may easily be oiled from one point.

Take-Up
Easily adjusted, smooth in operation, cannot chatter or seize.

NEWS and VIEWS

A collection of random thoughts, and some not so random; fact, fancy and opinion pertaining to the projectionist and projection matters. The free-for-all forum.

SEVERAL unions, harrassed by competition, have rushed into print in defense of their organizations. Letters to the editor and paid display advertisements extolling the organized labor body are appearing with increasing frequency. That which we said in our October, 1931, issue still holds good: people don't want to buy the Union, but they are customers for that which the Union should represent—quality work and safety guaranteed by a responsible organization.

Newspapers seldom, if ever, attack a labor organization as such. They can't afford to, circulation figures being what they are. Usually the press rails against the *direction* of a labor body, and a so-called browbeaten minority is induced to bear testimony against their own brother members.

The point of this item is that Unions should be particularly careful in distinguishing the focal point of any attack by the press—whether it be against the organization (which seldom is the case), against the individual or the directing group. Naturally, advertising copy intended to offset unfavorable publicity should be based on the point or points at issue. Otherwise, advertising money is wasted.

• The few copies of I. P. which go to France each month have already gotten in their deadly work. *News Item*: "Motion picture machine operators here (Paris), have formed an organization known as the Association des Operateurs de Projection Sonore."

Two organizers, please.

• Magnascope (enlarged screen), is old stuff. Yet, this is the one projection "stunt" that always draws the "Ohs" and the "Ahs" from any audience. Perhaps the foremost exponent of Magnascope is Harry Rubin, of Publix Theatres. As these lines are written Rubin is employing Magnascope in two Broadway theatres with marvelous results. One of the pictures, "The Doomed Batallion," is enhanced in entertainment value by about 25 per cent (in our estimation), through clever employment of Magnascope.

Great Care Necessary

The use of Magnascope calls for the utmost discretion and faultless execution. Sloppy use of the idea, or bad spotting within the feature, can do more harm than good. While we are on the subject, Rubin deserves much credit for the splendid special projection and effect work he employs to set off the Jesse Crawford organ presentations at the Paramount. When in New York don't' fail to catch some of this work.

• Bausch & Lamb Optical Co. are supplying a zippy catalogue of their projection lenses which contains valuable information for the projectionist. The screen image table on p. 11 should be ignored in view of the new standard aperture dimensions. A note to 691 St. Paul St., Rochester, N. Y., will do the trick.

• It probably isn't news any longer to many Alliance members, but we mention the resignation of William F. Canavan as a member of the staff of Publix Theatres Corp. Future plans not announced.

NOW that the social season for Local Union parties is over, the truth can be told. We have numerous letters from projectionists which tend to prove that our estimation of organization affairs as strictly *members'* parties is correct. Evidently some of the boys have long had in mind the idea which we spilled herein recently—that such affairs have been "packed" with outsiders and that much harm resulted therefrom.

We just can't help it if we have the power to read the boys' minds.

• Our erstwhile "boy friends," Messrs. Fred A. Jewell and Lester A. Smith, who for the past three years have been interested in "educating" the projectionist via Projectionist Sound Institute, of Easton, Penna.; Electrical Sound Institute, National Sound Service Bureau, Photo-Electric Research Laboratory and a few other Sound-this and Photo-thats, have just been convicted in New York Federal Court of using the mails to defraud. Our first foray against Jewell, *et al*, was three years ago, and we wound up our campaign against him in our November, 1931, issue. Then came the ""pinch." We don't know how much money we have saved members of the Alliance by our devotion to duty in this campaign, but certainly all locals should vote us a small donation apiece. On the right, please.

Incidentally, Mr. Jewell (himself), who tried first to bribe us and finally to punch us, is now on his way to Atlanta—glorious spot. Merry Xmas, Mr. Jewell—covering all three years.

IT doesn't require much neck-craning to discern the renewed interest in rear projection in this field. Most of the inquiries come from exhibitors who naturally are interested in the process because it appears to hold promise of a reduction in manpower. They're for it.

Anyone who has watched the progress of the intimate newsreel theatres which Trans-Lux has spotted about the country will have noted a marked improvement in the quality of rear projection. There is nothing mysterious about rear projection. Regular Simplex mechanisms are used (although it is rumored that Trans-Lux is building its own mechanism). The Trans-Lux screen is neither metal nor cloth; it has a gelatine base.

The Trans-Lux Lens

For years Trans-Lux has enjoyed a monopoly (through patent rights), on a special wide angle lens with prisms which gives a foot in picture area for every foot the projector is removed from the screen. Conversely, one could get a 2-foot picture at a 2-foot distance, a 5-foot picture at 5 feet, a 10-foot picture at 10 feet, etc. Considerable trouble was experienced with this lens at first (mostly a "lens spot" in which most of the available light would be concentrated), but this difficulty has been overcome and even illumination is now obtained.

It is doubtful if Trans-Lux will continue to enjoy a monopoly in the rear projection field, as good screens for this work are now available and Bausch & Lomb has recently developed a lens which also gives a so-called 1-to-1 effect.

WARNING!

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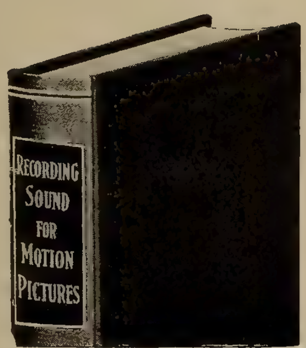
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(*Continued from page* 15)

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International PROJECTIONIST

Edited by James J. Finn

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July, 1932

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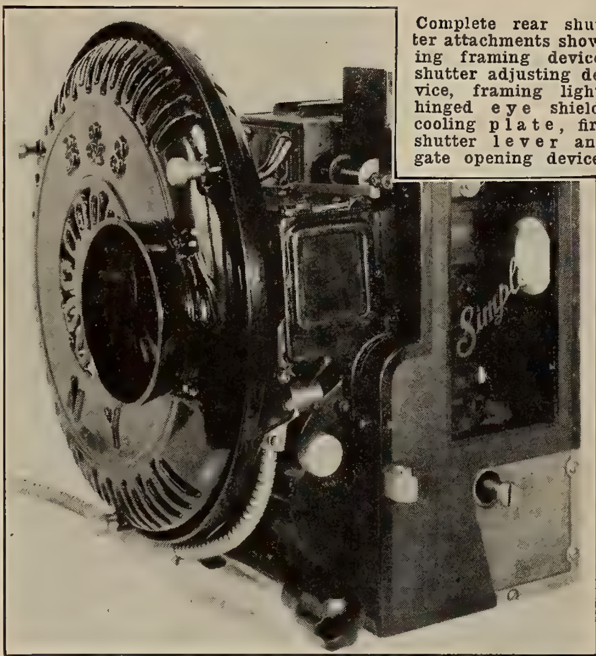
TWO NOTEWORTHY ACHIEVEMENTS IN PROJECTION EQUIPMENT



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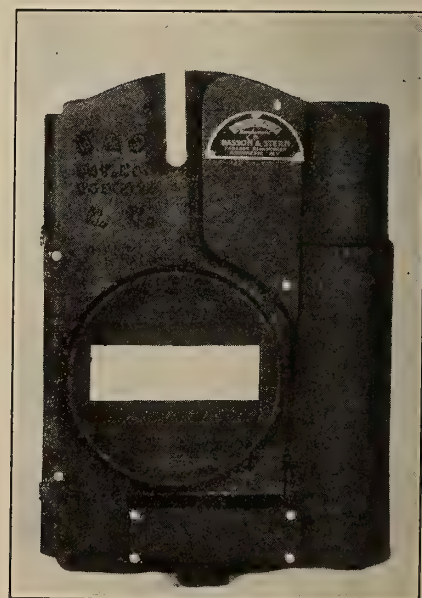

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INTERNATIONAL PROJECTIONIST is not responsible for personal opinions appearing in signed articles in its columns.

MONTHLY CHAT

WITHIN the confines of this issue appear many items which may best be described as "seasonal." The alert business agent will con the pages with shears in hand and should be able to glean therefrom a substantial addition to his larder. Catch on? . . . or must we go into detail?

THAD BARROWS, of Boston L.U. 182 and prexy of the P.A.C., may be blamed for this story about Stanislaus Hausner, member of L.U. 306, who recently was forced down in mid-ocean while attempting a projected flight from New York to Warsaw. It seems that Hausner, according to Barrows, was so interested in a copy of INTERNATIONAL PROJECTIONIST that he really didn't notice several ships that passed his floating plane.

The fact is that the foregoing is an even better story than Barrows figured it to be: for when Hausner arrived back home in New York, he admitted that *it was true*.

IN playing fair with our readers, we'll give our competitors (such as they are), a break. What everyone seems to want to know, but is having a devil of a time finding out, is just what equipment and how much adjustment and what is the total cost of adapting existing sound reproducing apparatus to the much-publicized but closely guarded "extended frequency range" system.

If anyone should uncover any facts relating to this mystery, would they please be kind enough to notify either Western Electric Co. or RCA-Victor, Inc., or both. These companies likely will welcome such information themselves.

OUR comment in the last issue anent rear projection stirred up a lot of interest in the projection field. Well, this month we unload ourselves of another burdensome question: Should film be waxed, and if so, how? Also, and between the same covers, we have our fling at the matter of servicing sound equipments. If we live out this month without suffering bodily harm, we shall feel reasonably sure that the so-called "freedom of the press" exists in fact as well as in fancy.

ONE upstart projection supervisor has unburdened himself of the idea that "too much supervision, particularly by district men, is undesirable." We agree—particularly when the field men know more about projection than does the national supervisor.

INTERNATIONAL PROJECTIONIST

VOLUME III NUMBER 1

JULY, 1932

LUBRICATION OF MOTION PICTURE FILM

J. I. Crabtree and C. E. Ives*

WHEN freshly developed or so-called "green" motion picture film is passed through a projector, there is a tendency for an incrustation to accumulate on the aperture plate and tension springs, which retards the free passage of the film through the machine. Chemical analysis has shown that this incrustation consists largely of gelatin with more or less silver, dirt, carbon dust, and oil, but it contains usually only a trace of the metal or alloy of which the gate is composed.

The effect of the incrustation is two-fold, namely: (*a*) It increases the friction between the metal parts of the gate and the gelatin coated surface of the film. This causes excessive strains on the edges of the perforations at the pull-down sprocket which ultimately results in torn perforations and, therefore, a diminishing projection life of the film, and

(*b*) The film is no longer held flat in the gate but oscillates in and out of the focal plane, producing the well known "in-and-out-of-focus" effects. Also, since the film is in a condition of varying strain between the intermittent sprocket and the aperture, the projected picture is unsteady. A similar action at the sound aperture causes a flutter in the volume and frequency of the reproduced sound.

If developed motion picture film is examined under a microscope by reflected light, it is seen that the gelatin surface is covered with innumerable extrusions (see Fig. 1, magnification 540), which impart a definite degree of roughness to the film. It is possible to smooth the film surface either by grinding away or burnishing down the minute projections or by filling-up the crater-like depressions. The effect of filling-up the depressions with wax and then polishing is shown in Figure 2, the left-hand side of which shows the surface of untreated film (magnification 540), while the right-hand side shows the same film after applying wax and burnishing.

The Burnishing Effect

Tests have shown that the mere act of burnishing or polishing the film surface without the application of a lubricant, such as wax or oil, does not appreciably facilitate the passage of the film through the projector gate. It is well known, however, that film which has been projected once or twice has a much less tendency to produce an incrustation on the gate than "green" film, and this is usually attributed to the burnishing or polishing action of the aperture plate or pressure springs on the gelatin coating of the film.

The burnishing effect produced by projecting film in a Simplex projector ten times is very slight as shown in Figure 3 (magnification 540). This is a photomicrograph of the film surface in the region between the perforations. The lower half of the figure shows a portion of the film surface which was in contact with the aperture plate, and it is apparent that the burnishing effect on the film surface was almost negligible.

Effect of Oil

It is considered that traces of oil which are transferred to the film surface during the first projection are chiefly responsible for the increased ease of passage of the film on subsequent projection.

It is obvious also that the moisture content and degree of hardening of the gelatin coating are important factors which determine the rate of formation of the incrustation on the gate. If the gelatin coating of the film contains an excess of moisture, it tends to soften and become "tacky" much more readily in the hot projector gate than is the case with dry film. This tendency of the gelatin coating to soften under the action of heat can be diminished by hardening

* *Kodak Research Laboratories, Rochester, N. Y.*

during processing; but excessive hardening tends to increase the brittleness of the film and is not to be recommended.

The following factors also determine the extent of the formation of the gate incrustation:

(*a*) *The Tension of the Gate Springs.* This should be of the order of 8 ounces for each spring or a total of 16 ounces. The spring tensions should be adjusted individually at intervals by attaching a spring balance to the upper end of a narrow film strip placed at one side of the gate and increasing or decreasing the gate tension until the film just commences to travel upwards, when the spring registers 8 ounces with an upward pull. In a like manner, the tension with full-width film should be adjusted to 16 ounces.

(*b*) *The Nature and Smoothness of the Gate Surfaces.* The nature of the gate material in contact with the film surface, providing it is of sufficient hardness, is of less importance than its degree of smoothness. Satisfactory materials are cast iron or stainless steel, either plain or chromium plated. Corrosion should be carefully guarded against and any gelatin incrustation removed with a soft metal scraper, such as a coin, so as not to scratch the polished surface.

(*c*) *The Temperature Existing at the Gate.* As explained previously, the tendency of the gelatin to incrust on the gate springs, in the case of freshly processed film, increases with the temperature. Any means of reducing the gate temperature, such as by the use of heat-absorbing glass, a water cell, radiating fins on the gate, or a blast of air impinging on the gate, produced either by a separate blower or by fan blades on the rear shutter, are desirable.

Methods of Facilitating the Passage of Film Through the Projector

Even though a projector is in good mechanical condition and the foregoing requirements are fulfilled, there is invariably a tendency for a gate incrustation to form with "green" film. Numerous methods of treating film to offset this have been suggested from time to time, as follows:

1. By coating the entire surface of the film with a suitable lubricant. Extensive tests have shown that of the various available lubricants, paraffin wax or machine lubricating oil are the most satisfactory lubricants for motion picture film. Only the merest trace of wax or oil, however, is necessary. This can be demonstrated readily by the following experiment:

Place a piece of motion picture film, gelatin side upwards, on a flat table and scrape the surface with the edge of a coin. It will be noticed that the surface is very readily scratched. Now, pass the finger through the hair, rub across the surface of the film, and again scrape the surface of the film with the coin. It will now be noticed that the coin passes smoothly and easily over the film surface without producing scratches—as a result of the transferance of a small quantity of oil from the hair to the film surface.

Surface treatment of the film with a suitable wax has several advantages as follows:

(*a*) The film has much less tendency to become scratched;

(*b*) The natural moisture in the gelatin tends to be retained, thus preserving the flexibility of the film;

(*c*) If oil is splashed on the film, the oil spots are not visible on the screen, whereas with un-

Do Your Share!

WAXING of motion picture film long has been a contentious topic among projectionists, laboratory workers, exchange men and theatre owners and managers. It is generally recognized that film must be lubricated to assure unimpeded transit on its first runs through the projector. Opinion is sharply divided, however, as to how best to accomplish this lubrication.

Various methods of lubricating film are described in the accompanying article by Messrs. Crabtree and Ives. One of these methods, that of edge lubrication, is preferred—although the writers specifically cite the strict necessity for employment of the correct concentration of wax and proper equipment.

Bearing on this highly important question is the appended abstract of a discussion incident to the reading of the Projection Practice Committee report at the last meeting of the S.M.P.E. Comment by Messrs. Crabtree and Edwards is self-explanatory and reflects accurately the prevailing difference of opinion on this topic among research workers and projectionists—with the former being in the position of rolling the bullets, so to speak, and the latter having to fire them.

It is of the utmost importance that a solution to this pressing problem be found. Calculable damage—film mutilation, damage to projector parts, and, frequently, fire loss—runs into many thousands of dollars annually. The loss occasioned by inferior projection—scratches, etc.—cannot, of course, be reduced to terms of dollars and cents. The question is: What is wrong with the present method of waxing film? This query involves consideration of (1) the method itself; (2) the application of the method in laboratories, and (3) the results obtained in theatres.

The last-named is by far the most important consideration. Any waxing process that does not give good results in the projection room is worse than useless: it is a positive menace to safety and a bar to good projection.

The projectionist is best in a position to pass judgment on the merits or demerits of the waxing system as at present constituted. His is the experience that counts, that provides the answers to such questions as: To what extent is wax accumulating in the gates of projectors today? Does the accumulation consist of wax, dirt, gelatin, or a mixture of these? What is wrong with the present methods?

The projectionist is strategically situated to render a great service to projection, to his craft and to the industry generally by contributing his findings to this symposium on present waxing conditions which will be conducted by INTERNATIONAL PROJECTIONIST with the cooperation of Eastman Kodak Company. Every projectionist who can possibly do so should contribute to this symposium. Opinions based on daily experience in the projection room are desired. A majority of the opinions will be published in these pages. A sufficient number of contributions, if indicative of the need for a change, would pave the way toward the application of corrective measures.

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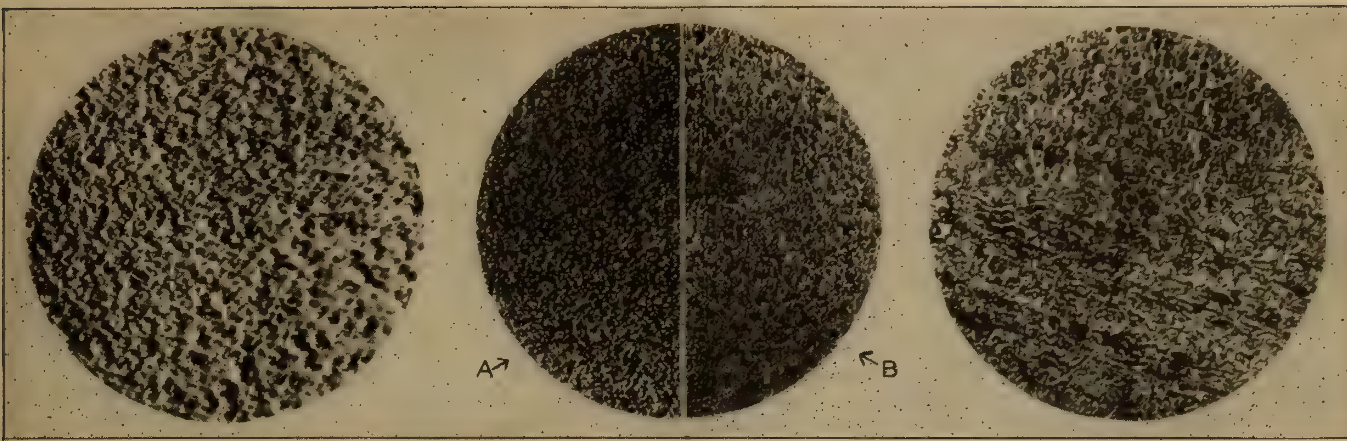


FIGURE 1 FIGURE 2 FIGURE 3

Fig. 1: Photomicrograph showing appearance of surface of motion picture film by reflected light. Fig. 2: Photomicrograph showing (A) untreated film, and (B) effect of coating film surface with wax and then polishing. Fig. 3: Showing burnishing effect on film during projection. Upper half—unburnished; lower half—burnished

treated film the oil spots are very objectionable on projection; and

(*d*) Extensive tests have shown that the film has a much less tendency to accumulate ground noise with use.

If a soft wax coating such as paraffin is used for the surface treatment, it is apt to attract dirt; so it is preferable to use very hard waxes which, in turn, are not the best lubricants. The necessary lubrication is provided by applying a lubricating wax or oil to the edges as described hereafter.

The above double treatment of film is relatively expensive, and due to the advent of biased recording and the greater care with which film is handled, ground noise is not as serious a factor as was previously the case.

Lubricating Film Edge

2. By treating the edges of the film with a suitable lubricant such as paraffin wax or lubricating oil.

A number of years ago it was customary to apply a thin line of wax along each edge of the film surface and between the perforations by means of a machine similar to that illustrated in Figure 4. This machine consists essentially of two parallel thin steel disks separated by a distance of 1 3/32″ rotating in a vertical plane. The disks dip into a bath of molten paraffin wax and apply the wax to the film at their upper edge. The quantity of wax applied is controlled by the thickness of the disks, the temperature of the molten wax, and the rate of travel of the film.

The above method of lubrication is entirely satisfactory, providing the wax is applied correctly. However, if the temperature of the molten wax is not sufficiently high during application, too much wax is applied by the disks and this does not solidify sufficiently before the film is rewound. This causes the wax to cement the edges of the film convolutions, so that on rewinding, particles of wax are torn away from the film and these tend to incrust on the picture area, causing spots and splotches on the film.

Particles of wax also tend to lodge on the sound track with deleterious effects and they likewise accumulate in the reproducer aperture, thereby diminishing the volume of reproduced sound and, in some cases, cutting off the sound completely.

Another very serious danger resulting from the application of an excess of wax arises if the projector is threaded while hot with film coated with an excessive quantity of wax. As the projector cools, the wax solidifies and holds the film so tightly that on starting the projector, the intermittent sprocket may tear out the perforations instead of pulling the film down through the gate. Also, since the fire shutter opens immediately when the projector starts, more or less film is apt to be burned up if the film does not start to move down promptly past the aperture.

Repeated tests have shown, however, that this trouble is not likely to occur

S.M.P.E. Symposium on Waxing

Mr. Crabtree: I noticed that the committee regards the waxing of film as undesirable. With the early method of waxing, when the film in the waxing machine became too cold, it accumulated on the blades and was applied too thickly to the film. It then caused trouble at the projector gate. But I should like to recommend a change that has been made—to use a solution of the wax, the concentration of which controls the amount of wax applied, so that it is impossible to apply too much wax unless the solution is too concentrated. I made a survey of the different laboratories in New York, and found that 95 per cent of them are using a solution of wax for edge waxing. To what extent is wax accumulating in the gates of projectors today? Does the accumulation consist of wax, dirt, gelatin, or a mixture of these? What is wrong with the present method?

Mr. Finn: It doesn't require extended research to uncover the fact that waxing of film is, to say the least, undesirable. I don't think it presumptuous to state that a majority by far of projectionists do not desire that film be waxed—that is, as waxing is now done by certain laboratories.

Mr. Richardson: The chairman of the Committee is a supervisor of projection, and everyone on the Committee engaged in practical projection made the statement that no method of waxing has yet been used that would not result in some deposit in the sound gate. Yesterday we were told that waxing of film to be used in the Navy's projectors is taboo. It was said that there is no waxing process that is not objectionable.

Mr. Edwards: I agree with Mr. Richardson. Our experience in a first-run film house has shown that it is necessary to take out the sound gate and clean out the accumulation of wax after every running. If this is not done, we soon find that we have a "frozen" film in the gate.

Mr. Crabtree: Yet 95 per cent of the laboratories are using this process of waxing. I feel that if trouble is being experienced, the laboratories are using a stronger solution of the wax than is recommended.

Mr. Edwards: It is quite possible that the fault lies not so much in the process as in the application of the process. Probably as much care is not taken in applying the wax as was intended by the inventors of the system. We have to dig out the wax from the grooves in the rollers up to the tenth run. If neglected for one reel, we often find that the heat of the plate will melt the wax and the film will adhere to the gate.

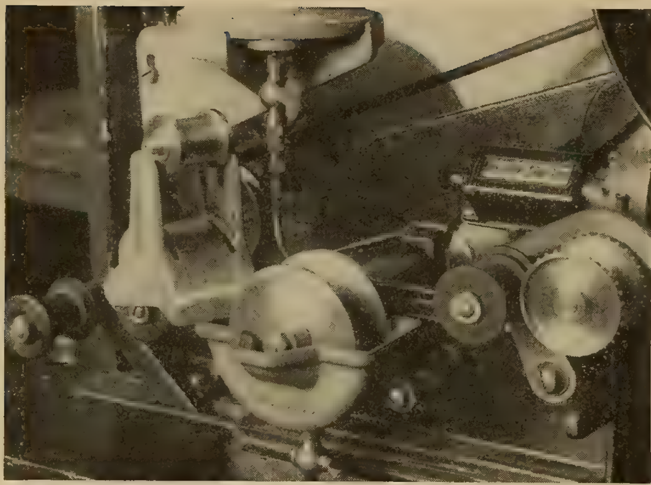


FIGURE 4
Showing application disks of new Eastman edge waxing machine which apply a 5 per cent solution of paraffin wax in carbon tetrachloride to the edges of the film. On evaporation of the solvent, only the merest trace of wax remains on the film; but experiments have shown that only 4 grains of wax per 1,000 feet of film are necessary to provide adequate lubrication

unless the film contains five or six times the quantity of wax normally applied by the waxing machine.

3. A much more satisfactory method of edge lubrication consists of applying a solution of wax or oil in a solvent by means of the machine shown in Figure 4.

The advantages of using a solution of wax in a solvent such as carbon tetrachloride are briefly as follows:

(*a*) No heating unit is necessary and thereby the fire hazard is removed.

(*b*) Extremely small quantities of wax may be applied consistently.

(*c*) The quantity of wax applied is independent of the temperature and is determined only by the concentration of the solution, the width of the blades, the speed of rotation of the blades, and the rate of travel of the film.

If the correct concentration of wax is used,—namely, 5 per cent or 6½ ounces of wax in 1 gallon of carbon tetrachloride—this means that only 4 grains of wax are applied to each 1,000 feet of film, and with this quantity no visible accumulation of wax should occur in the projector gate even after projecting six or seven rolls of film.

During a discussion on theater practices at the recent convention of the Society of Motion Picture Engineers at Washington, D. C., Mr. G. C. Edwards[1], a supervisor of projection, stated that he had recently encountered difficulty due to the accumulation of an excessive quantity of wax in the projector gate. An investigation revealed that the laboratory which processed the film in question was using the solution edge waxing method, so that it could only be concluded that the laboratory was either using a solution of wax which was too concentrated, or the solution in the application pot had been allowed to concentrate by evaporation of the solvent in contact with the air.

Practical tests have shown that a solution having a concentration as low as 2 per cent of paraffin wax in carbon tetrachloride, in most cases, will give satisfactory lubrication.

4. Other miscellaneous methods of lubrication which have been proposed from time to time consist of the following:

(*a*) The application of a lacquer over the entire gelatin surface of motion picture film. Such lacquer coatings are non-lubricating although they have the advantage that if oil has access to the film the resulting oil spots are not visible on the screen;

(*b*) Super-hardening the gelatin with substances such as formalin. Although this method tends to retard the softening of moist gelatin in a hot projector, the process is non-lubricating; and

(*c*) A large number of solutions of unknown composition have been proposed from time to time, but to date no practical tests have been forthcoming which indicate that such methods lubricate film more satisfactorily than a thin coating of paraffin wax or lubricating oil.

To Summarize: The method of lubricating film by applying a thin coating of a 5 per cent solution of paraffin wax in carbon tetrachloride to the edges of film after development and previous to projection is considered satisfactory. With film treated in this manner no visible accumulation of wax should appear in the projector gate even after seven or eight 1,000-foot rolls of film have been projected successively. If a visible accumulation of wax forms in the gate, then an excess of wax has been applied to the film and the projectionist should make the recommendation to the exchange that a more dilute waxing solution be used.

Under normal conditions, a soft dark colored deposit will form in the projector gate, consisting of fluff, dirt, carbon dust, silver, and gelatin which, normally, is removed easily by wiping after projection. If the film was not lubricated sufficiently, a hard incrustation forms on the gate or the tension springs which can be removed by scraping with a coin but never with a steel or iron instrument.

[1] Brooklyn, (N. Y.) Strand. Past President, American Projection Society.

SPECIAL P. A. C. MEETING IN NEW YORK

MANY projection problems were considered at a special midsummer meeting of the Projection Advisory Council which was held in New York City during the month. In addition, extremely important matters of Council policy were discussed and agreed upon.

The session, which ran for more than four hours, was presided over by President Thad Barrows, president of Boston L.U. 182. The meeting was opened by P. A. McGuire, executive vice-president, who gave a brief résumé of the activities of the Council during the past few months. It was pointed out by Mr. McGuire that despite the limited budget of the Council for the present period, much beneficial work had been accomplished—work which he cited as laying the groundwork for valuable contributions to the craft in the future. Mr. McGuire also read the agenda for the session which he had opened.

A resolution adopted at the session advocated a greater interest by the International Alliance as an organization in the purely technical aspects of projection work and requested President Barrows to confer with the General Office of the I.A. on the matter.

Harry Rubin, Council treasurer, submitted a report of finances covering the past six months, which was accepted by the Board. Larry Jones, secretary, read several communications from British projectionists requesting information on various projectionist activities.

Projectionist Interest Sought

P. A. McGuire stressed the need for a wider interest among organized projectionists in the work of the Council and cited the desirability of a greatly increased membership. James J. Finn was appointed chairman of a special committee to devise ways and means of effecting a closer contact between the Council and projectionist local unions throughout the country.

The next general meeting of the Council will be held early in October.

SUPERIOR CRAFTSMANSHIP IS BEST FIRE INSURANCE

M. D. O'Brien

ASSISTANT DIRECTOR OF PROJECTION, LOEW THEATRES, INC.

One of America's outstanding projection supervisors holds that safety in the projection room, and consequent protection of an audience, depends not on preventives and fire-fighting apparatus but on you, Mr. Projectionist, who oversee the equipment and direct the performance.

MILLIONS of dollars are expended annually for the upkeep and maintenance of fire-fighting apparatus throughout the United States, yet millions of dollars worth of property is destroyed in the same period. Theatres, factories, garages, stores and similar public places are equipped with fire-fighting apparatus. The various insurance and protective companies demand that approved fire extinguishers and sprinkler systems be installed.

City, county and state officials insist that proper precautions be observed—that a certain number of fire exits, properly equipped and strategically located, be provided.

Automatic fire alarms, manually-operated alarms and other fire-detecting systems are employed. Even public and private firemen are stationed about public places to assure ample protection to the public.

But with all this equipment, with all the signals and alarms and sprinklers and other extensive apparatus that is used, in addition to the employment of special fire officers, there is really nothing that can be said to prevent fire—that is, nothing that operates mechanically. The tremendous expenditure for protection against fire serves only to detect and to fight fire. So-called fire prevention devices do not prevent, but merely hinder the spread of, fire..

Who Is Responsible?

Particularly is this true of projection work. The projectionist himself is the most vital link in the chain of fire prevention in the theatre. Given the most up-to-date protective equipment, a theatre still is almost wholly reliant upon the projectionist for an adequate measure of security.

In the projectionist's hands lies the security of a theatre audience. His watchfulness, care in handling inflammable and combustible materials and his ability to visualize the tremendous importance of his position are the measurements of the degree of protection against fire existing in his theatre.

All the fire-fighting apparatus and safety appliances in the world cannot prevent a careless person from dropping a cigarette or lighted match upon or near combustibles. All the signalling systems and alarms combined cannot prevent the practice of permitting dirt and refuse to pile up to such an extent as to constitute a fire hazard.

A theatre has that degree of protection against fire that is reflected in the alertness and carefulness of the projectionist. He is the one definite safety factor within the theatre—the one man upon whom everyone else in the theatre must rely for protection against fire.

Defective Equipment

A projectionist should formulate and then religiously adhere to a fixed routine relating to protective measures. First and most important is the strict necessity for the exercise of the utmost care in handling not only film but every piece of equipment in the projection room. Next in importance is his duty to keep his equipment scrupulously clean and free from any substance or refuse which might constitute a fire hazard.

All equipment should be kept in a constant state of repair. Worn and defective parts constitute a major fire hazard, and the projectionist who knowingly works with defective equipment is perpetrating an injustice upon the audience, which is in his safe-keeping, upon his employer, upon himself and his organization.

To the projectionist's care is intrusted the care and handling of a great amount of machinery which in itself presents no particular fire hazard. He is also entrusted with the care of thousands of feet of film which may be said to be nothing more or less than readily combustible gun cotton. The latter does present a very definite and extremely formidable fire hazard.

In reflecting upon some of the occurrences within projection rooms, I have concluded that a majority of projectionists permit their tremendous responsibilities to rest too lightly upon them. It shapes up as just a case of never giving the matter a thought, and one might very easily become lax and careless. After a fire it is too late to think about what might have been done.

It appears that many of us are only too willing to believe that "It never could happen to me." It can happen to anyone; and the fact that is *does* happen is demonstrated by advices from the National Board of Fire Underwriters which show that four or five film fires are reported to its offices daily. Just think! every day four or five possible sources

Canadian Film Fires

THE following information was gathered by the Dominion Fire Marshals and Dominion Theatre Inspectors of all provinces, covering theatre fires which occurred in Canada during 1930 and 1931. The records fail to show *any* case where a projection room fire spread beyond the projection room itself.

	1930	1931
British Columbia	7	4
Alberta	1	2
Saskatchewan	4	1
Manitoba	6	3
Ontario	17	7
Quebec	2	1
New Brunswick	0	0
Nova Scotia	1	0
Prince Edward Island	0	0
	38	18

Figures relating to theatre fires in the United States are not available, although the National Board of Fire Underwriters receive "four or five theatre fire reports daily".

Just one item in the long list of fire hazards—and the type of equipment that no self-respecting craftsman would permit to be used

of tragedy. Our attitude should be: "Tomorrow it might be me."

The nature and the extent of damage done by a given projection room fire is of secondary importance. The fact that *a fire* occurs is our primary interest. Today's small and inconsequential fire might be tomorrow's tragedy. Accompanying this article is an abstract from a report of a fatal fire which occurred sometime ago in Utah. It might be, it could be *you*.

Regular Safeguards

Film should be stored in the proper type of enclosure to insure against its coming into contact with an open flame or any piece of equipment the temperature of which may be above that of the atmosphere. Film which is carelessly left lying about may be ignited from such sources as short-circuited wiring, unprotected rheostats (it *has* been known to happen); by pieces of hot carbon dropping from the lamphouse and, the records show, by strong sunlight beating through glass. We reserve for last mention of that superior being who can smoke a cigarette while examining film. Such an idiot is nothing less than a criminal.

When a film fire occurs in a projection room today there is a reasonable assurance that it can be controlled to the point which little damage beyond the destruction of a few feet of film will result. But . . . the audience knows nothing of our control procedure, and one little flame, one whispered word can result in tragedy which no amount of afterthought or fire-prevention equipment can repair.

The history of our business proves that there have not been more than a half dozen film fires originating in projection rooms which have done material damage to the other sections of the theatre. But there have been hundreds of fires originating in the projection room which have been the direct cause of thousands of fatalities—which is the thought uppermost in the mind of every projectionist worthy of the name. Damaged film is expensive, true. But it shouldn't be mentioned in the same breath with damage to human life.

How many projectionists gaze out of the room ports and, surveying the audience, are struck by the overpowering force of the thought: "These people trust me. They must, else they wouldn't be here"? Try it sometime. It will do your sense of craftsmanship, if not your soul, good.

What are the best means for providing against possible projection room fires? The answer is: just a few simple rules.

Prevention Requisites

In addition to exercising extreme care in handling film, keep your projectors in such mechanical condition that you never have to worry about whether they are functioning properly. This can best be done by *constant inspection* of the various parts—yes, even a daily inspection is advisable. Look at your sprockets daily. Inspect the film shoes and tracks at least two or three times a day. Watch the take-ups. Keep the entire projector sufficiently well-oiled to permit of minimum wear of the gears and spindles.

Replace worn parts before they have deteriorated to the point where they will damage film. Worn parts are the worst reflection on craftsmanship. Remember that damaged film, occasioned by worn parts, is the most likely source of danger from fire. Yes, film still ignites when piled up in front of the aperture.

Repair and replace defective parts. Replacing defective parts is the highest form of fire prevention. A true craftsman will not tolerate worn or defective parts; but if the craft instinct is not sufficient to force you into action, you might remember the presence in the theatre of several hundred, or more, people who come to your theatre because they trust you.

In addition to assuring mechanical perfection of your equipment, observe a rigid routine in cleaning your equipment and the projection room. Dirty sprockets, tension shoes and tracks cause many breaks and tears in the delicate fabric of the film. Such breaks may run through once or twice but eventually

Hollywood Brains

"We have about five men in Hollywood who have enough knowledge of music, drama, literature and graphic arts, to start shooting a picture. (Names on application.) All the other directors could go back to school or kindergarten, as the case may be.

"The only men worthy of praise in Hollywood as a class are the technicians—photographers, sound men, electricians, etc. Technically the craftsmen are ten years ahead of the alleged creative workers."

ERIC KNIGHT,
Philadelphia Public Ledger.

"It Can't Happen to Me"

THE following is an excerpt from an article which appeared in a recent issue of INTERNATIONAL PROJECTIONIST[1]. The statement quoted is a verbatim transcript of the testimony of a theatre usher made at an inquest held to ascertain the cause of the death of a member of the Provo (Utah), Local Union::

> "I was the first one to reach the scene of the accident, being attracted to the projection room by an explosion. As I remember, the accident occurred about 8:00 p.m. I rushed to the projection room and found it full of smoke. When I got there the door was closed, and I could hear shouts from within calling 'Help! Help! Ican't see.' Graham (the projectionist), managed somehow to open the door just as I reached for it.
>
> "I rushed into the room and as I faced him I could see he was burned from head to foot. His clothing was burned from his body and he kept crying out that he couldn't see. I took my coat off and put it around him; but he threw it off crying that he couldn't stand it. By this time he was burned beyond recognition. I finally succeeded in getting my coat around him and, with the help of an usher, took him downstairs to Dr. Arnold Robinson's office which was adjoining the theatre. . . ."

[1] "A Model Form of Propaganda for Projectionist Unions," by George A. Yager; INTERNATIONAL PROJECTIONIST, December, 1931, p. 31.

they "catch up" with the careless man.

Torn bits of film deposited in the bottom of the mechanism or lying loosely around the room make for a fine film fire. Débris which is permitted to accumulate on the floor and in the corners of the projection and rewind rooms are at once an indication of what type of craftsman works in a given room and a source of great danger.

"It Might Be You"

To itemize each and every detail connected with a projectionist's daily routine would require more space than is available herein. The "punch" of this article lies in the emphasis placed upon the statement that fire prevention in a projection room depends absolutely upon the projectionist and not upon any particular departmental ideas on fire-fighting apparatus or preconceived notions governing fire-eliminating equipment.

Let each projectionist pay strict attention to the handling of film and let him keep in mind the fact that a perfectly operating projector kept up to the highest standard of repair is worth a ton of fire prevention equipment.

In closing we revert to the statement that few fires spread beyond the projection room. This is true . . . but the projection room, and not the stage, happens to be where the projectionist is stationed, and any trouble that results will naturally be handed out in large doses to that man who is handy—to you, Mr. Projectionist.

Independent Dealers To Meet in Chicago

THE Second National Convention of the Independent Theatre Supply Dealers Association will be held at the Stevens Hotel in Chicago August 12 to 14, according to a recent announcement by President Joe E. Robin. Invitations to attend have been extended to all manufacturers of theatre equipment and supplies, and ample space will be provided without charge to any manufacturer wishing to distribute his products.

A unique feature of the Convention will be the privilege accorded all manufacturers or their representatives to address the supply dealers either publicly or in private.

Under the very able leadership of Joe Robin the Independent Theatre Supply Dealers Association has become an important unit in the theatre equipment field. Mr. Robin's extensive knowledge of the theatre field, coupled with his fine engineering talents and the desire to improve the service rendered by independent dealers, is reflected in the fast-growing prestige of the Association.—J.J.F.

Notes on the Auditory Response of the Human Ear

THE normal human ear has a tremendous range of auditory response. Over the band of frequencies from 500 to 2,000 cycles it will respond to the almost unbelievable energy range of one hundred million million to one—equivalent to 140 decibels in telephone terms. This range is bounded at the lower level by the intensity of sound that is just audible, and at the upper, by the intensity that becomes painful. The sensitivity is not alike at all frequencies, however.

If the upper and lower limits of hearing were plotted on an absolute pressure scale both would curve: the upper convex upward, and the lower convex downward. For the purpose of studying hearing loss, however, it is convenient to employ a straight base line and to indicate the range of pressure to which the ear will respond at the various frequencies as the curved line shown on Figure 1.

When a person is hard of hearing, the range of pressure that he can hear is decreased, and the amount it is decreased at the various frequencies can readily be indicated on a chart like that shown. The same base line may be retained but a new line, representing the person's range of hearing, is plotted from data secured with an audiometer. Such a curve is known as an audiogram, and Figure 2 gives such an audiogram for the two ears of a person we may refer to as Mr. A.

As shown by this curve, a sound of 1,024-cycle frequency, which could just be heard by a person of normal hearing, would have to be increased 60 decibels, or sensation units, to be audible to Mr. A. Lower frequencies require less amplification and higher frequencies, more. The audiogram of a person totally deaf would be on or below the broken line representing total loss of serviceable hearing.

Because of the great range in both pitch and intensity that the ear possesses, a person may lose part of the ear and not notice it. Our ears may not respond to some pitch ranges or to some intensity levels that are easily heard by others, and yet he may not be conscious of the fact.

When the hearing loss is about 35 sensation units, it becomes noticeable in conversation, especially with a group, and difficulty is experienced in hearing at a theatre or in some similar situation. When the loss is appreciably more than this amount, we become definitely conscious of lessened hearing acuity. In noisy places we may still fare very well, however, since all voices are being raised.

These and many other interesting facts have been gleaned by the technical staff of Bell Telephone Laboratories in the conducting of experiments to produce a satisfactory hearing aid. Such data are of more than passing interest to all those interested in sound reproduction in the theatre.

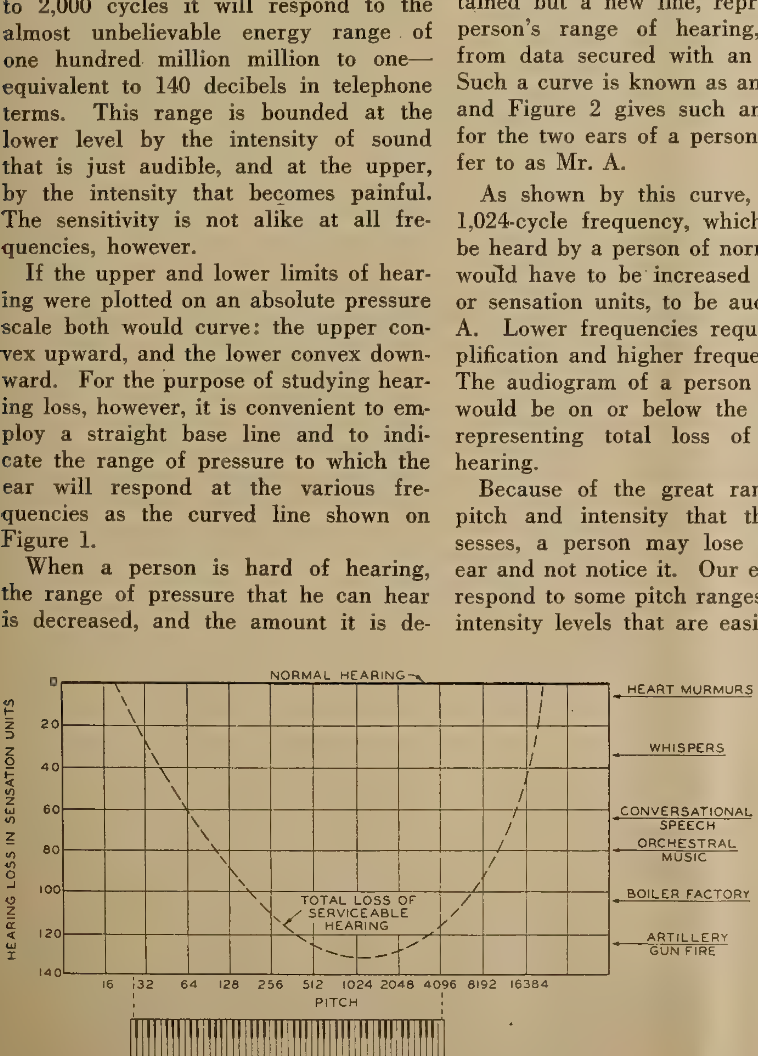


Fig. 1. The auditory area. The curved line represents the hearing loss necessary at various frequencies to produce total deafness

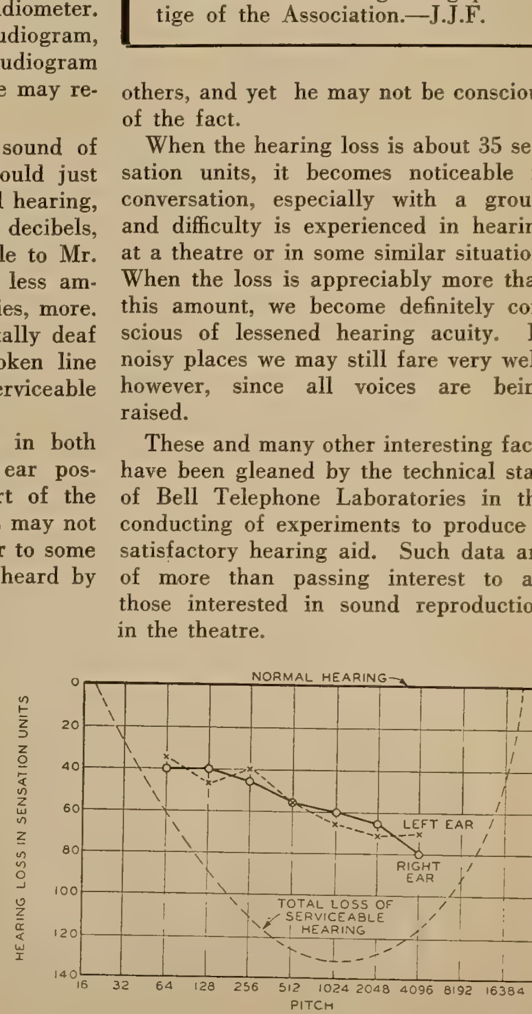


Fig. 2. An audiogram for Mr. A whose hearing loss runs from about 40 db at 64 cycles to 70 db at 5,000

THE QUESTION OF SERVICE FOR SOUND SYSTEMS

James J. Finn

THE amount and cost of servicing sound reproducing equipments in theatres is one subject which no publication has had either the courage or the inclination to discuss. The reason for this hesitancy on the part of those otherwise exemplary scissor artists is obvious . . . or must we tell?

Costs and quantity of servicing are inseparably joined. The projection field is vitally interested in the amount of service; but costs also must be considered. Let's first look into this matter of costs. "A graft", "a steal" and "an easy way to pile up millions for the electrics" are some of the descriptive phrases applied to the service charge. Forgetting for the moment certain other aspects of the matter, let us suppose that the implications contained in the foregoing statements are true. One comment immediately suggests itself: "What of it?"

Exhibitors long ago were taught by film distributors that a thing is worth what it brings. Picture merchandising is based on that premise. Why, then, insist upon a complete change of tactics on the part of the so-called electrics?

Question of Profits

The question of profits derived by the electrics from the lease or sale of sound picture equipments has absolutely no connection with the cost of servicing those equipments—even though the income from service operations goes to make up a portion of those profits. Equipments were and are sold and leased at a certain figure. Service charges are based on so much service for a given type of equipment. If the exhibitor does not approve of the terms of sale or lease of sound equipment, he may do without.

Harsh words, it may be said; but none the less expressive of the situation. By what right, real or fancied, does Mr. Exhibitor proceed to dictate to the electrics the limits of their profits?

Does Mr. Exhibitor deny the legitimacy of exploiting the new or novel on any basis deemed fit and proper by the possessor thereof? Did Mr. Exhibitor contribute to the cost of research, development, manufacturing, patent protection and, finally, merchandising the sound picture equipment? Not one cent. Does Mr. Exhibitor say that, being the possessor of a rare animal having a potential worth of many thousands of dollars, he would sell the animal to a zoo or a circus for one dollar, simply because he wanted to help amuse the children? Nonsense.

The right of the electrics to make that profit which they deem proper is as unquestionable as is the right of the exhibitor to change his program at stated intervals and ask of the same group of people another admission fee.

Profits simply do not enter into the matter of service charges—or, at least, they should not.

Frequency of Service

Frequency of service is a question on which the electrics themselves are split. One camp holds to a certain number of inspection calls a month; while another camp, yielding to exhibitor pressure, instituted a policy of less service for less money.

Service charges are of interest to projectionists only because of their direct tie-up with the amount of service. But the *amount* of service is of vital importance to projectionists.

Servicing, as applied to sound picture equipment, has its origin in the economic axiom that it is cheaper and more effective to prevent trouble than to cure it. This is especially applicable to theatres, where equipment trouble means not only replacements and repairs but also losses arising from refunded admissions, postponed performances and a disgruntled patronage.

The very nature of show business justifies the policy of service as a preventive rather than a cure. Showmanship demands that every precaution be taken *in advance* of any possible trouble rather than that efforts be doubled to apply a corrective after the emergency has arisen.

Show business is as remotely different from coal mining as is black from white, yet those who hold to the principle of as little service as possible place show business in the same category as, for example, coal mining. A breakdown at a coal mine means that no coal is mined for one day, two days or for the duration of the breakdown. But after repairs are effected at a mine, double shifts of men can be put to work to mine sufficient coal to make up for the lag of production. Show business is not that sort of business.

Theatre Income

The breakdown of equipment in a theatre means that whatever patronage is lost during the period of inoperation is irretrievably lost—never to return. One minute, one hour, one day—it matters not the extent of the shutdown—that period's business is lost and can never be regained. The business of the next day, the next hour or the next minute is business secured during that period only and cannot be applied to any other time period.

Smart showmen recognize this peculiarity of their business, and that is why they offer little, if any, opposition to ample servicing operations. Why quibble about service charges when a reduction of service may effect a loss during one day totalling three or four times the cost of a year's service? Those who are loudest in protesting the cost and quantity of sound picture servicing usually are the poor showmen.

Who, in either the sound equipment business or in the exhibition field, is capable of stating with authority the exact amount of servicing necessary for a sound picture equipment? Let us assume that Exhibitor A concludes that his theatre need be serviced only once a month. The chances are very good that he could run along on this basis for two months, three months or even six months without encountering an emergency situation. But when his luck ran out (as he likely would express it), the one emergency call might cost him for equipment in refunds, loss of patronage and damaged prestige several times the amount of increased servicing.

Inspection to Emergency Ratio

That regular inspection calls have a very direct bearing on the number of emergency calls for a group of average theatres has been proven conclusively by the experience of at least one sound company. This being so (and figures prove that it is so), what intelligent showman can read such figures and still

oppose the policy dictated by their figures?

All the discussion in the world cannot alter the fact that trouble-prevention is the goal of adequate servicing, and that the yardstick of measurement should be an equipment's freedom from breakdown and emergency needs.

In the conduct of an adequate servicing plan efficient equipment operation has been sought and watchfulness in anticipating trouble has been a watchword. Ever increasing experience on the part of engineers, more comprehensive testing equipment, broadened projectionists' knowledge, improved and simplified equipment and the ability through organized approach of the problem to spread and apply the advantages gained from each passing month's experience have been important factors in the development of the result.

Let's consider another analogy. Let's forget about the term "servicing" and think of the operation as insurance. Where lives that man who can accurately forecast that death will not overtake him between the ages of, say, 24 and 45, and who therefore concludes that it is foolish to pay insurance premiums during that period of his life? That man, if he be sane, probably doesn't exist. Yet the campaign for reduced servicing of sound picture equipment is the product of a reasoning even less intelligent and logical.

Less Service Harmful

If service charges can be reduced and the frequency of service maintained, all well and good. Operating costs is the answer to this problem. But a reduction of service charges for a *reduced amount of service* is a policy which should delude nobody and which should be opposed by every projectionist, every exhibitor and every executive in this business.

International Projectionist has been, and will continue to be in opposition to any plan which embodies a reduction in the amount of servicing given to sound picture reproducing systems in the theatre. Reduced service charges which entail a reduction in the *amount* of servicing surely is the easiest but hardly the sensible method of handling the matter.

The present tendency on the part of exhibitors to neglect not only the sound equipment but the projection equipment as well reflects a misunderstanding of the first principle of show business: the show must go on. Exhibitors may be duped by the argument of "less expense," but the exhibitor who follows such a trail inevitably comes a cropper.

International Projectionist urges projectionists to exert their utmost influence in the maintenance of an intelligent and showmanly service policy.

PROGRESS IN THE MOTION PICTURE INDUSTRY

An Abstract of the Report of the Progress Committee of the S. M. P. E.

WHEN the new high-speed panchromatic films were first introduced about a year ago, cameramen used them chiefly for interior work. During the past six months they have been adopted quite universally for making exterior shots, so that it can be stated that the bulk of the pictures being made at the present time in American studios are being photographed on the new improved films. Commenting on the improved films, Hall reiterates the opinions previously expressed by cameramen that the significant property of the product is not so much the increased speed but the "tremendous improvement in photographic quality . . ." obtainable by using the new film.

New Materials.—A recent addition to the group of films is the Pankine G-Antihalo film supplied by Agfa. According to Schilling, this film is said to be fine grained and to possess greater senstivity to red, yellow, and green rays than the older Pankine F film. A bluish green anti-halation layer is incorporated between the emulsion and the support, which layer is unaffected by the processing solutions and necessitates only a slight increase in the printing light.

Cheap Metal Film

According to D. C. Dunham, Herr Kupfer has completed the development of an aluminum motion picture film band. Because the base is metallic, light must be reflected from it. Refining the clarity of the reflection and achieving in the emulsion combinations that would adhere to the metal have been the two greatest difficulties encountered in completing the invention. In projecting pictures from this metal-backed film, light from the arc is reflected from a mirror to the metal film as it passes over the projecting slot, the light falling on the film at an angle of incidence of 45 degrees.

It is claimed that the film itself cost between one-fifth and one-sixth of the amount for the celluloid film, and it is also claimed that the metal is more durable than celluloid, does not stretch, and will not break so easily. It is claimed that the new film has been perfected for sound and color reproduction. One hundred and thirty patents covering the production and reproduction of pictures from this film have been taken out in the various countries of the world.

The Eastman Kodak Company has classified its panchromatic materials into three groups, known as Types *A*, *B*, and *C*. Group *A* includes materials of the same type as those made prior to 1931; group *B* materials, known as "orthopanchromatic," have an extremely high color-sensitivity, corresponding approximately to that of the eye; group *C* materials called "hyperpanchromatic," have a high total sensitivity, and are extremely sensitive in the yellow, orange, and red portions of the spectrum. Eastman su-

(*Please turn to page* 26)

W. E. Presses Unusual Patent Suit

THE question of whether a patented article can be used without authorization from or compensation to the holder of the patent is raised in an unusual suit that has just been brought by the Western Electric Company against the operators of the Gibbs Theatre, Youngsville, Pa.; in the U. S. District Court, Western District of Pennsylvania.

Under the terms of the W. E. contract the sound projection equipment is leased for a period of years to an individual theatre. A transferral of equipment to another theatre, according to the contract, can be arranged only by mutual consent.

The suit that has just been filed arises from the fact that a Western Electric equipment was installed in the Strand Theatre, Greensville, Pa. When the operator filed a voluntary petition of bankruptcy, the landlord seized the equipment. It was sold to the landlord's trustee at a sheriff's sale to go toward paying arreas in rent owed by the theatre operator. Subsequently it was bought by A. W. Gibbs and installed in the theatre he operates in Youngsville.

Western Electric's suit claims infringement of 29 patents. It contends that the equipment was leased to the Strand Theatre and licensed for use in that theatre only and that its unauthorized use in another theatre constitutes a violation of the Western Electric Company's patent rights.

The action is the first of its kind to which Western Electric has been a party and involves some distinctive legal points, so that its outcome will be watched with close interest both by the motion picture industry and by members of the legal profession.

VIBRATION: RELENTLESS ENEMY OF GOOD PROJECTION

R. G. Hess

VIBRATION has long been recognized as a serious handicap to good sound reproduction and to perfect projection of the motion picture. In addition to interfering with quality presentation of sound and picture, vibration is an aid to wear and tear of all moving parts of a given equipment. Vibration isolation cannot be termed a new science, but its application to projection vibration problems is a matter of comparatively recent date.

For many years cork has been utilized in all general vibration isolation installations. It is not denied that cork has served well its primary purpose, which is to *ease* the vibration; but it may be said in all truthfulness that cork has been tested and found wanting for *isolation* work. The special problems which came into being with this fast-moving age of daily scientific advances proved conclusively that moving parts of an equipment which was designed for hair-breadth accuracy required something better than cork as a protective against vibration.

Such a substance is now available and is being merchandised in America under the trade name of "Keldur."

What Is "Keldur"?

Keldur was developed in Germany in 1918 as a synthetic rubber. Keldur resembles rubber in general appearance and characteristics, but is radically different in several of its properties. Unlike rubber, it retains its resiliency over long periods of time, it does not oxidize or harden, and it does not "go dead." Among its very favorable characteristics is the fact that it is not affected by oil.

Another outstanding Keldur characteristic is its pronounced "damping factor," or "time lag," in its reaction to vibration impulses, and it is this feature which is responsible for its extreme efficiency in the *absorption* of vibration —a single 3/8″ thickness being from 85 to 100 per cent more efficient in this respect than is a 2″ thickness of the very best natural cork available.

For maximum efficiency when used for large areas an edge surface should be provided to permit the material to "give" easily under vibration impulses, and this is accomplished by breaking up the area into strips or by perforating with holes comparatively close together over the entire surface, as is indicated in the accompanying diagrammatic representations of typical installations.

A single thickness of Keldur is highly effective under loadings of from 1 to 30 pounds per square inch; and in a double thickness up to 50 pounds per square inch, under frequencies ranging from single impacts up to 1,600 cycles per second.

The actual carrying capacity of Keldur is in excess of 200 pounds per square inch, insuring a large factor of safety, particularly in consideration of the fact that the average loadings met with in vibration isolation practice range from 1 to 20 pounds per square inch, including the allowance for impact.

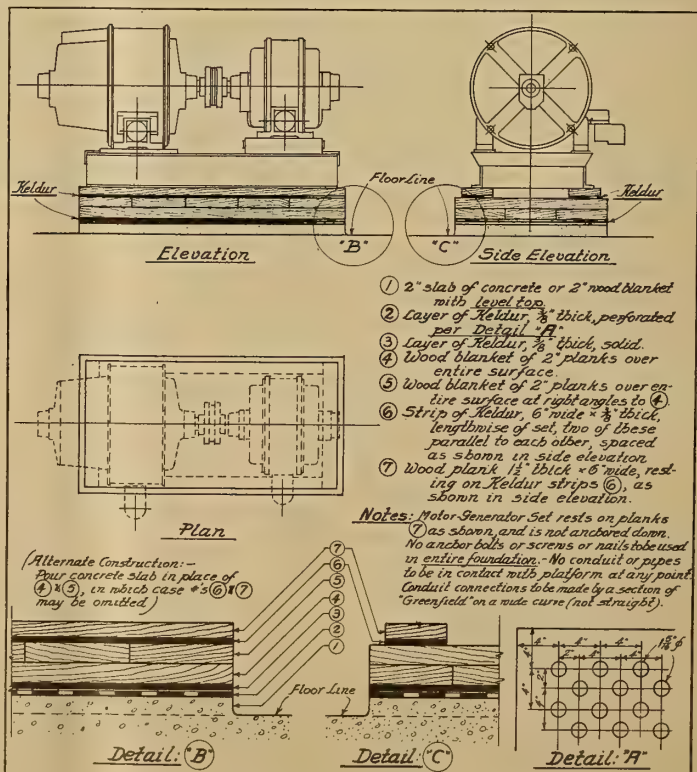
Projection Applications

Keldur is manufactured in sheets 36″ square, standard thickness being 3/8″, although it is obtainable in 1/4″ and 1/2″ thicknesses for special applications.

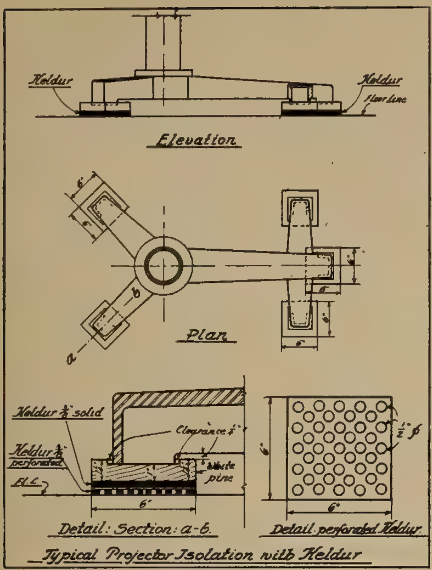
In no branch of the theatre field is the need for a product such as Keldur more pronounced than in sound and motion picture reproduction work. Acceptable sound reproduction means the elimination of all harmful vibration, and projectionists long have known that good projection requires steadiness of a projector to an extent best described by the term "rock-bottom".

The illustrations accompanying this article represent typical Keldur installations as they have been made in theatres operated by such well-known circuits as Warners, Fox, Loew's, Publix, Randforce and many others, and are exactly correct in detail covering the installation in the new Warner Theatre in Ridgewood, N. J.

One of the first in the projection field to recognize the worth of Keldur as a vibration isolation material was Mr. Frank Cahill, of Warner Theatres; and in this company's new theatre in Ridgewood, N. J., all mechanical equipment is isolated with Keldur. The unusual freedom from vibration, and consequent clarity of sound and picture reproduction, enjoyed by this theatre lends more



Typical Motor Generator Set Isolation with Keldur



than passing interest to the details of the installation.

As is shown in Figure 1, a 4-inch concrete sub-base is first poured and then leveled off on the top. After this dries, a single 3/8″ thickness of Keldur is laid over the entire top surface and is perforated in the pattern represented by the detail in the illustration. The purpose of the perforation is to afford edge pressure-relief, i.e., some place for the material to "give" or "relieve" into under the vibration impulses.

Various perforation schedules are available, the type used in each case being dependent upon all factors involved: dead load per square inch, impact load per square inch, nature and frequency of predominating vibrations and impulses, natural amplitude of movement of machine bases, etc. The several schedules of perforation involve changes in the size of holes and their center spacing.

The Keldur is laid between tarpaper, the overlapping joints of which are sealed with pitch. The 10-inch slab which carries the equipment is then poured, with a layer of small mesh wire screen being used to preclude the possibility of stones in the concrete breaking through the tarpaper into the holes in the Keldur. After the forms are removed care is exercised to insure that no cement has sealed over the edge of the Keldur to join the top and bottom concrete slabs; as this would short-circuit the isolation and nullify the effects of the installation.

Each piece of equipment and its driving motor (all V-belt drives), are anchored to the top concrete slab. The latter is not anchored in any way and "floats" on the Keldur. The weight of the load in combination with the surface friction existent between the concrete and the Keldur prevents any shifting of position.

Needless to say, all conduit connections to the motors and motor generators have a *curved* connection of flexible conduit; and all water piping has double bends with unsupported lengths which will "spring".

In the isolation of a projector it is necessary that vibration be eliminated to the very highest degree, and for this reason a double thickness of Keldur under each point of the base is recommended. One of these thicknesses should be solid and the other perforated. The bearing surfaces under the two larger feet on the pedestal end should be about 6″ square and those under the other three feet (on a five-point pedestal), should be about 4½″ or 5″ square.

Due to the fact that the feet are cored out so as to give an edge bearing of only ½″ wide, it is necessary to use wood blocks or steel plates which will distribute the weight uniformly over the area of Keldur provided.

While the need for vibration isolation in the modern projection room is generally recognized by engineers and progressive projectionists, it is only among the larger circuits that a full appreciation of the importance of this subject is encountered. Within the ranks of the smaller exhibitors there exists a remarkable tendency to consider vibration isolation as an expensive luxury. Some small theatres do "play" with the idea, however, but their efforts in this direction are usually confined to experimenting with a cheap, ineffective material which is usually inefficiently installed.

A Keldur installation does not mean an expensive installation, as is evidenced by the fact that a projector may be isolated for approximately five dollars.

It does not require much vibration to seriously detract from the quality of reproduction of both sound and picture. and the larger theatre circuits have discovered that the small outlay for a material such as Keldur should not stand in the way of quality reproduction.

ELECTRICAL REFLECTIONS DATA COMPILED AT BELL LABORATORIES

ENERGY in any form will be partly reflected when it suddenly encounters a change in the resistance to its passage. Whether this change is an increase or a decrease, some reflection will occur. Careful observation of a thick pane of glass will always disclose two partial reflections of the objects facing it: not only the one where the light leaves the air and enters the glass, but another where the light emerges again to meet the air.

In a similar way, electrical reflections take place at discontinuities in the impedance of a line through which electrical energy is passing. A portion of the energy of an electrical impulse that reaches such a point in a line is thus returned to its source.

The fact that reflections will take place at discontinuities of impedance can readily be made apparent. This reflection of energy obviously diminishes the efficiency of the line.

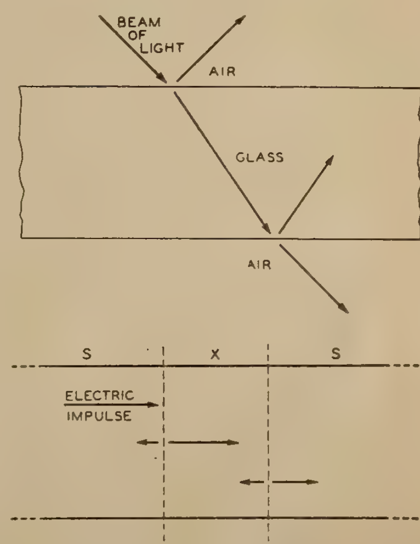
Those interested in sound reproduction will be interested to know that when the line is used for speech reproduction, far worse effects are possible. Reflection may introduce distortion by affecting certain frequencies more than others, cause disturbing echoes by returning the speech signal to its source after a noticeable time interval, limit the gains at which repeaters can be operated, or increase cross-talk between circuits.

If these effects of reflection become large enough to be important, their compensation can be accomplished only by expensive means, such as equalizers, echo suppressors, impedance-modifying transformers, and more frequent transpositions on open-wire lines, and in some cases only by reconstruction work to remove the irregularity.

While extensive research on this problem has not yet been undertaken, the Bell Telephone Laboratories (Telephone Apparatus Department) has recently completed some interesting work relating thereto, the results of which are described in the *Bell Laboratories Record*[1] under the caption "Electrical Reflections and Their Measurement".

This article describes a special measuring apparatus by means of which a rapid check can be made of the reflection coefficient of a piece of apparatus at a particular frequency.

[1] Vol. 10, No. 11, July, 1932.



Electrical reflection is somewhat analogous to optical reflection

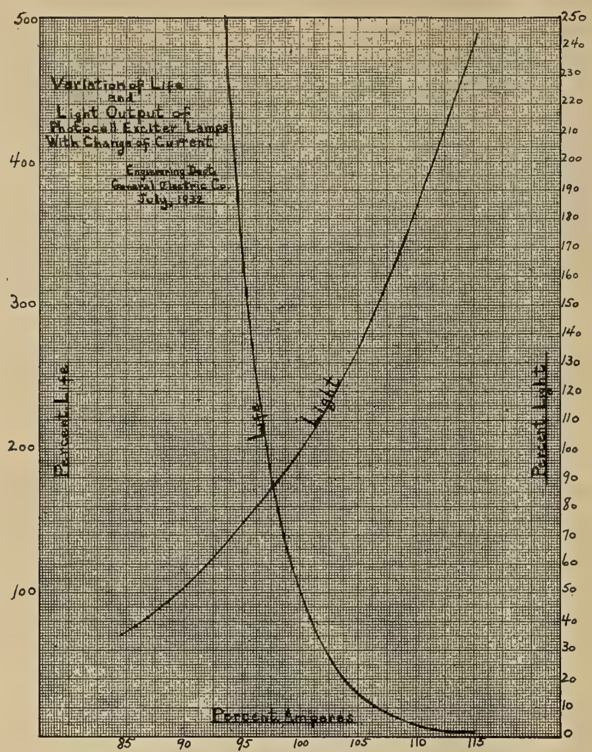


Figure 1. Graph showing variation of life and light output of exciter lamp with change of current, which indicates clearly the result of operating lamps at lower than rated current value. Since all exciter lamps behave similarly, the data is expressed in percentages and may be applied to any make of photocell exciter lamp

EXCITER LAMP LIFE AND PERFORMANCE

Harold W. Watkins

IN order to obtain a satisfactory signal output from the photo-cell in the sound-head, the exciter lamp must have a high light brillancy, since we are restricted to the light from one lamp only, and this light must pass through the narrow slit of the optical system. High light intensity is obtained by operating the filament at a high temperature. While the light intensity increases very rapidly with filament temperature, the evaporation of the filament increases at an even greater rate, consequently a compromise must be effected between the useful life of the lamp and the need for high light output.

The evaporation of the solid filament requires some explanation. Many have no doubt noticed that ice evaporates without melting, particularly on a windy day. This is due to the fact that solids, as well as liquids, have a tendency to pass into the gaseous state, and are therefore surrounded by a vapor of their substance. A wind removes this surrounding vapor as fast as it is formed, until ultimately the solid has completely evaporated.

Reducing Evaporation

The same process of evaporation takes place in the case of the lamp filament, and the higher the temperature of the latter, the greater is the volatization. The vapor formed then condenses in the form of a film on the relatively cooler glass walls of the bulb, blackening it.

There is one method of reducing this evaporation, and that is to surround the filament with a gas, which "blankets" the metal and thus prevents it from volatilizing.

The gas used in practice is a mixture of argon with a little nitrogen, which mixture does not react chemically with the tungsten filament and also does not conduct heat very readily from the filament. In this way the filament may be operated at a very high temperature—with resultant high light brilliancy, without undue evaporation of the filament.

To further conserve the amount of heat conducted away from the filament, the latter is wound in a coil, so that the dead gas film normally surrounding one part of the wire and through which heat conduction takes place, overlaps that of another part of the wire.

This explains the choice of a helical type of filament construction in the gas-filled lamp as compared with the umbrella-type of construction used in the vacuum lamp.

In spite of the gas atmosphere, however, some evaporation takes place, as evidenced by the gradual blackening of the glass bulb. This not only decreases the transmission of light through the bulb, but represents a definite amount of filament removed from active service. Eventually the filament becomes so thin, and its resistance consequently so high that it burns out. This thinning process is usually more pronounced at certain points on the filament, and it is at one of these points that the filament melts (burns out).

Since tungsten when cold has a much lower resistance than when hot, much greater current flows at starting than during normal operation, and this aggravates the local heating noted previously, so that an old lamp usually fails when first turned on, and generally at one of these thin spots.

A. From the foregoing, it can be seen why exciter lamps do not last as long as ordinary incandescent lamps. The average life of the former is about fifty hours, which compares favorably with incandescent projector lamps, spot lights,

and other lamps of high brilliancy.

B. When the glass walls of the lamp become so dark that the gain of the amplifier must be materially raised, it is good economy to replace the lamp with a new one, even though its filament still lights up. The reason for this is that the ground noises of the amplifier become objectionable at high gain, and the advantages of noiseless recording is thereby lost.

C. The formation of an oxide as a white deposit inside the glass bulb is an indication of air leakage. A common cause for such leaks is the excessive tightening of the set screw of the exciter holder which process cracks the glass wall where it is cemented to the base. Such a lamp will burn out in no time, and should be replaced immediately.

D. From the foregoing it will be noted that a reduction in exciter lamp current increases its life to a greater degree than it reduces its light emission. Therefore, to obtain longer life, it is advisable to operate exciter lamps at some current value lower than the rated. It is best to operate the lamps at a value recommended by your service engineer. Currrent values lower than those recommended are liable to affect the output materially, necessitating operation at higher gains, with consequent background noise.

The foregoing discussion was submitted for inspection to Mr. R. E. Farnham of the Engineering Dept., General Electric Co., makers of exciter lamps. Mr. Farnham, who has contributed much interesting lamp data to these columns, offered the following comment:

Addendum

By R. E. Farnham

I WAS very much interested in the article by Mr. Watkins which was submitted to me for comment by the editor of INTERNATIONAL PROJECTIONIST. I can readily appreciate the difficulty experienced by many projectionists in thoroughly understanding the relationship between exciter lamp life and the quality of reproduced sound.

The life of the photocell (exciter), lamps has a very direct connection with the theatre owner's pocketbook; while good quality sound is rather intangible and generally a matter of opinion—hence the temptation to operate exciter lamps below their rated current value.

Evaporation Process

In the Watkins article, the general discussion of gas-filed lamps is quite good and substantially correct. However, the conclusion reached in Section A thereof does not necessarily follow. All gas-filled lamps, whether they are designed for fifty hours or for one thousand hours life, go through the same phenomena of evaporation and spot evaporation, and the shorter life of the exciter lamps is due to their being designed to operate at a high brightness in order to secure the maximum amount of light through the optical system.

The material given in Sections B and C is quite worth while.

Section D of the article by Mr. Watkins is contradictory, inasmuch as its first two sentences advocate lower current operation as a means of gaining longer lamp life, while the last sentence advises against it.

It is generally recognized among engineers interested in the development of sound picture equipment that a larger amount of light incident on the photocell than is now possible, would be desirable, particularly so because increased light would reduce the amount of amplification necessary, with consequent reduction of background noise. Analysis of a sound optical system shows that the light reaching the film comes from only a small part of the filament area of the exciter lamp; and since increasing the wattage of the lamp merely increases the filament area, no gain in illumination would ensue from such a procedure.

Filament Temperature

Increasing the brightness of the filament, with consequent increase of filament temperature, is therefore the only method available to secure greater illumination at the cell. Increased filament temperature results in shorter lamp life.

Thus, the entire problem resolves itself into securing the best balance between lamp cost and good quality sound with freedom from background noise.

Study of this problem by both ourselves (G.E.), and those interested in the production of sound equipment has shown that when the lamp filament is operating at a temperature that gives an average of fifty hours life, sufficient light reaches the cell to give ample volume of sound without requiring such high amplification as to raise the extraneous noise to an objectionable level. On this basis, lamp renewal cost is not a serious factor.

Lower Current Values

As is evident from the accompanying curve sheet (Fig. 1), operation of the 8.5-volt, 4-ampere lamp at 3.9 amperes would not occasion serious trouble and would hardly produce any audible effect. If projectionists stopped at this point, no harm would result. But the temptation to operate at lower current values is often great, and they cut down to 3.8 amperes, then to 3.7 and even lower, with the result that the quality of reproduced sound is most seriously affected—and because the change probably has been gradual, the seriousness of the situation is not noticed. Nevertheless, much of the improved quality of sound pictures effected recently, notably the so-called new noiseless recording development, is destroyed.

Managerial Interference

Therefore, I firmly believe that projectionists should adopt as a general policy the operation of exciter lamps at the rated current value marked on their bases. I do believe that a majority of projectionists desire to follow this policy, but are hampered in so doing by the interference of managers and owners who have in mind the effecting of a small petty economy—if it can in truth be called economy when it results, as it does, in inferior sound quality.

Managers and theatres owners, as well as those projectionists who are in the

Brownell Resigns "M. P. P." Editorship

CHARLES E. BROWNELL, well-known in the motion picture field as a writer on the technical aspects of cinematography and for the past year editor of "Motion Picture Projectionist," has resigned his office with that publication, according to a statement authorized by Brownell. A trained engineer, Brownell's editorship reflected technical intelligence and good writing style, and his resignation, which was entirely voluntary on his part, occasioned much surprise in projection ranks.

Mr. Brownell has had a wealth of experience in the technical branch of the industry, having previously served with RCA Photophone, Inc., as an instruction book and specification writer. He has been actively associated with the electrical engineering profession for the past 15 years. The former editor's home is at 11 Mountainview Place, Montclair, N. J.

habit of operating exciter lamps at below their rated current value, should be made to see what a small item is exciter lamp renewal cost when viewed in relation to the total cost of projection room operation and should note carefully how an attempt to reduce this cost can seriously depreciate the entertainment value of the picture.

I have before me as I write a clipping from the May, 1932, issue of INTERNATIONAL PROJECTIONIST, which constitutes a forceful presentation of the story, and it might be well to reprint this item as an appendage hereto. The data contained in this item, you will note, checks very closely with the figures shown on the curve sheet (Fig. 1). The data in this curve sheet is presented in percentages so that it may be applied to any of the photocell lamps, since they all behave in similar fashion.

NOTE: The material in the May, 1932, issue of I.P. referred to by Mr. Farnham is appended hereto:

EXCITER LAMP RATED CURRENT

Present types of exciter lamps were developed in response to a desire on the part of sound engineers to obtain more light through the optical system. Since these new types were introduced for the purpose of furnishing additional light, their very purpose is defeated by operating them far under the rated current.

At 3.6 amperes—a current reduction of 10 per cent—the light output is only 50 per cent of the light output when the lamp is operated at 4.0 amperes.

The same principle applies to the systems using the 10-volt, 5-ampere, and the 10-volt, 7.5-ampere lamps:—a three per cent reduction in current causes approximately a twenty per cent reduction in light output. Three per cent less current doesn't look like much on an ammeter, and perhaps it doesn't require much of a change of fader setting to compensate for the loss in volume, but it's a step in the wrong direction.

It is easy to accuse the lamp manufacturers of having a selfish interest in desiring to have the lamps operate at their full current. But the sound equipment people wish the exciter lamp to give as much light as possible in order that the apparatus will function at its best. And those having the problem of the theatre operation in mind will question the advisability of even slightly jeopardizing sound results in the interests of making a lamp last a few hours or days longer.

PARAMOUNT COLOR PROCESS

Although technical developments have been generally halted owing to current economic conditions, Paramount continues to work on its new color process, which is practically ready. The system will not be put into use until conditions improve. Paramount's new season feature schedule does not specify any color.

NEW 'SPLIT' RECORDING PROCESS TO SAVE HALF MILLION YEARLY

INFORMAL discussion of methods of adapting sound recording and processing equipment to a new technique described as "split film recording" was held by the executives of the sound and laboratory departments of eleven principal Hollywood studios at a recent conference at the Academy of Motion Picture Arts & Sciences.

'Split Film' Technique

An economy of more than half a million dollars a year for the industry is anticipated through the greater efficiency of this new technique. This will maintain a high quality of sound in the final product, but the changes are confined to studio processes and will not affect release prints of theatre reproduction.

The "split film" technique permits sound recording on 17½ mm. or one-half the width of the standard 35 mm. positive which has been used for recording on film. In the method adopted by the M-G-M studio, sound track film is run through the recorder once, then turned over and run through again, which puts a sound track along each side. After developing and drying the film is split to separate the two sound tracks for matching with their corresponding picture negative in the subsequent synchronizing and editing processes.

Methods by which 17½ mm. width stock is used for the original recording and editorial processes were also discussed, official announcement of which will be forthcoming shortly.

Jean A. Le Roy

JEAN A. LE ROY is dead.

Death claimed a grand old man when it reached down into a little basement home on the East Side of New York recently and took Jean Le Roy out of this world. For Le Roy was more than a splendid technician—probably the outstanding motion picture technician of his time—he was a grand, game fighter and the sort of man whom anyone would be proud to know.

Jean Le Roy died a poor man after having made contributions to the art of motion pictures that have amassed millions of dollars for less capable technicians, if not actually less honest men.

Born in Bedford, Kentucky, 78 years ago, Le Roy early came to New York and engaged in the photographic business, from which he graduated into motion pictures after a few years. On February 5, 1894, Le Roy projected through his apparatus, the "Marvelous Cinematographe," the first motion picture. Peep-box pictures preceded this demonstration, of course, but there isn't any doubt that Le Roy projected the first motion picture. Subsequently he launched the first road showing of pictures ever undertaken.

Inadequate patent protection barred Le Roy from participation in the profits of his inventions, several of the most prominent of which were pirated and exploited commercially by others. But there wasn't a spark of hate in Jean Le Roy's heart when he left this world. Of that one can be sure. Even when he was stricken with a paralytic stroke three years ago, Le Roy never lost courage, never lost hope and never lost faith in the humanity of man. Just why he did not shrivel up into a mass of bitterness and hatred will always be a mystery to those who knew the story of Le Roy's life.

Every man who carries an International Alliance card is indebted to Jean A. Le Roy, who was a grand fighter for organized labor in the formative days of the Alliance.

Of rewards in this life, Le Roy enjoyed few. Honorary memberships in the S.M.P.E. and in the A.P.S. probably represented the peaks of recognition accorded this fine old fighter. Still, Jean Le Roy will not lack an adequate requiem, for the thousands of whirring projectors in as many thousands of theatres throughout the world will continue to express mechanically a lasting tribute to one of the finest characters that ever graced the motion picture industry.

JAMES J. FINN

The EDITORIAL PAGE

Vol. 3, No. 1 JULY 1932

Official I. A. Interest in Standards

We note with great satisfaction the adoption by the recent midsummer meeting of the Projection Advisory Council of a resolution advocating a greater interest by the International Alliance as an organization in the purely technical aspects of projectionists' work. This is a fine day's work and a move that will be commended by every forward-looking projectionist member of the Alliance. Anything that the Alliance as an organization can do to improve the standard of work done in the projection field, and particularly the standard of work done by its members, is sure to redound to the great benefit of every individual member as well as to that of the organization.

All that is asked of the Alliance in this direction at present is moral support; the serious technicians, among whom may be counted many prominent Local Union officials, do not ask for the establishment of a bureau or for the expenditure of any money. But they do ask for encouragement and a favorable attitude on the part of the Alliance as an organization.

Of course, we might crow "we told you so," since we have been advocating such a move for lo, these many months. Our efforts in this direction were attacked by one "safe and sane" bunny in an editorial in his sheet. What has this automatic safety guard to say now that the P.A.C. has formally endorsed the project? Probably nothing, in view of the extensive P.A.C. membership.

'Our Friends' and 'Economy Moves'

Economy moves, so-called, by certain producer-exhibitor circuits, have resulted in the discharge of sectional projection supervisors. This is one of the dumbest moves that has ever been made by the executives in this business. How much more humiliating is it to the craft that one of its own members is responsible for the adoption of such a policy! Yes, it's unbelievable—but none the less true.

The system of supervision by competent men for a given number of theatres within a certain district has been the outstanding factor in the advancement of projection work. The very nature of show business demands close supervision of all departments of the theatre, and in no department is the need for supervision more pronounced than in that of projection. Still, the smart executives of this business, who have proven their ignorance of things projection on scores of occasions, are satisfied that there exists no need for trained field men.

That member of the craft who is responsible for this turn-about-face on the part of theatre executives should certainly feel proud of having accomplished a dirty day's work. And many other happenings of a similar stupid nature have occurred on the particular circuit which we have in mind at the moment. Let it appear here on the record in cold type the promise of the management of International Projectionist that such tactics on the part of a so-called "friend of projection" will not be allowed to go unpublicized. We shall confine ourselves at the proper time to a discussion of the question strictly on its technical merits; but it is to be doubted that once we have had our say, the matter will be judged by our readers solely on that basis.

The Exhibitors Swing Into Action

The Motion Picture Theatre Owners of America is collecting data which will "prove that the fire hazard is no greater with one man than it is with two men in a projection room." We wish the M.P.T.O.A. luck in this venture—and they will need a ton of well wishes, if they hope to have their efforts crowned with success. Coincidentally, we print elsewhere in this issue some very pertinent data relating to the fire hazard in a projection room. But, after all, Mr. Exhibitor need not run the risk of being toasted by a film fire while standing in the lobby.

Also coincidentally, another gleaning from the month's news has to do with the efforts of a group of New York exhibitors to secure a radical reduction in insurance rates, and one of the arguments used to buttress their appeal to the underwriters is the fact that "improved projection work and modern equipment has greatly minimized the dangers of film fires."

We do not hold that fire may best be fought with fire, but we cannot help observing that the appearance before the underwriters of projectionist representatives in opposition to one-man operation would hardly help in the campaign for lower insurance rates. At any rate, when the M.P.T.O.A. presents its findings, we shall be glad to offer a number of interesting arguments in opposition to any reduction in man power.

Service—With Or Without a Smile

International Projectionist is appealed to from time to time by local unions, individuals and commercial organizations for data relating to the projection field. While this publication is glad to be of service, and particularly to its readers, it can do only that which is within its power, or, more modestly expressed, within its means. Often, data requested is not available at once and its collection entails not a little effort and accompanying expenditure of time. Again, certain data requested is beyond our means to produce.

We write these words not in any critical vein, but merely to ask that our correspondents exhibit just the least degree of common sense and exercise a bit of patience when seeking our aid. Glad to help we always are; but there are some tasks which we find to be beyond the range of even our expansive capabilities.

DISEASES OF THE UPPER RESPIRATORY TRACT

Harry W. Brown, M.D.

Insurance companies' records prove conclusively that the most common ailment among projectionists is an infected condition of the respiratory tract. Irregular hours, unscheduled and unbalanced eating, and the fact that most projection rooms are poorly ventilated, are contributory causes of such ailments. The inception and development of such diseases, together with many helpful suggestions for minimizing their danger, are set forth in the accompanying article.

FREQUENT colds, sinusitis, pharyngitis, laryngitis, bronchitis and la grippe, are the maladies most commonly responsible for a great deal of the suffering and incapacitating of man. In this article I will attempt to visualize the onset and course of these diseases and outline some of the general preventives for them.

The common cold or, as it is called, coryza, is an infection of the nasal cavity. This infection usually clears up in a few days, causing no further trouble. It may, however, by blocking up the sinuses, produces a sinusitis.

From the diagram accompanying this article it is clear that all the sinuses drain into the nose, and when the lining of the nose swells from inflammation, it interferes with this drainage, causing a congestion and inflammation of the sinuses. Repeated infection of the sinuses will produce a chronic sinusitis.

Nasal Infection

Nasal infection can extend into the pharynx, which will result in a pharyngitis (sore throat). The location of the tonsils, as illustrated in the diagram, is in the region of the pharynx and will become infected when this area is involved.

An extension of the pharyngitis down to the next portion of the respiratory tract will involve the larynx, producing laryngitis (hoarseness and an irritative cough). The infected lining of the larynx, when it extends into the bronchi, will result in bronchitis (frequently productive cough and pain). If the infection moves farther down the respiratory tract into the lungs, pneumonia and pleurisy will be the result.

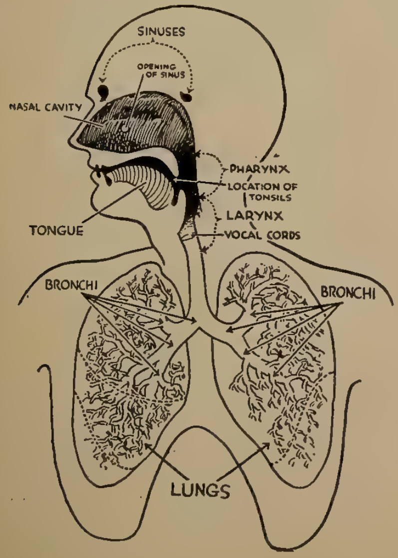
The germs which cause these infections are of numerous types and their normal habitat is the mouth, nose and pharynx. The factors causing these dormant germs to become active are the commonly known causes for colds, such as over-exertion, lowered resistance, improper ventilation, too dry and artificially warmed air and an unhealthy or diseased condition of the tonsils, sinuses, teeth or lining of the nose.

Any one of the above infections may originate in the way mentioned above, or a person may have a head cold, sore throat, pharyngitis, etc., without the infection extending farther down the respiratory tract. The exact ways in which these infections start are not always clearly understood, but by the observation of trained physicians we know that a general rundown condition caused by improper living, reduced resistance, as a result of an improperly functioning organ or infection, will subject a person to these minor but distressing diseases.

Improper Aeration

Improper aeration is an established cause of sinusitis and infection in the nasal cavities. This improper aeration may be due to some obstruction in the nose, such as a crooked septum or a growth in the nose. These obstructions interfere with the drainage of the sinuses, giving the germs a better chance to infect these cavities.

Too poorly ventilated rooms will irritate the lining of the nose, causing it to



CHANGE TO NEW APERTURE SHOWS ECONOMIES

WITH the distribution of 104,000 instructional leaflets on the new uniform frame size for theatre projectors, sponsored by the Academy of M. P. Arts & Sciences, the campaign to secure uniformity in the photography and projection of the motion picture "frame" will soon come to a successful conclusion.

The economies and improvement in photographic quality anticipated are becoming apparent as the transition is completed from the previous practice.

In the studios time formerly required in providing for multiple composition may now be devoted to securing more artistic effects in the picture frame which is to reach the screen and in shortening preparatory work on the set. The single frame has made it possible for theatres to abandon the various aperture shifting devices in general use and to save the related upkeep and replacement costs, as well as insuring that all the action photographed in the studio will be projected to the screen in pleasing proportions.

Practically all releases from American studios are now photographed through the camera aperture recommended by the Academy and the educational campaign to secure uniform projector practice in theatres throughout the United States and Canada is being completed. Information is also being distributed to the theatres in Great Britain and continental Europe through arrangements made by the foreign office of the M.P.P.D.A.

The specifications and related data have been published as a Bulletin Supplement, which may be obtained from the Academy office.

Attention—Projectionists!

The questions posed by the article on film lubrication which appears on page 7 of this issue have a vital bearing on your daily work. It is of the utmost importance that the points enumerated therein receive careful consideration by all projectionists. Your opinion on this pressing question is important. Send in your comment at once. Address all communications to INTERNATIONAL PROJECTIONIST.

react by swelling and predisposing to infection. The places in which we work or live should have circulating air with the proper amount of moisture and a normal temperature.

Diseased tonsils, sinuses or bad teeth are often the site of virulent germs which will produce any of the above infections. The tonsils may not swell or become painful, the patients believing there is nothing wrong with them, but on examination they will be found to be unhealthy and cryptic, possibly enlarged, and if pressure is put on them, pus can be seen.

Impaired Resistance

Some people have a low resistance to the infection of certain of these germs. These people will have frequent colds and respiratory infections on the least provocation. These people are always dodging drafts and catch cold very easily after bathing or any change of weather. In other words, they are subject to these infections with a minimum amount of lowered resistance or from the slightest exposure to another person who has a cold.

If you are a person who has frequent colds, that is, over four or five during the winter months, you should investigate your condition and have a thorough examination by a physician, to determine if there is any focus of infection or obstruction or abnormality which may be responsible for these frequent attacks. A general hygenic routine—proper amount of sleep, proper food, regularity at meals, exercise, outdoor activities and a recreational program—is a very important means of increasing the general physical resistance to infection in general, and in particular to upper respiratory diseases.

Adequate Ventilation

Make sure that your sleeping chamber is well ventilated. This can be accomplished by cross-ventilation of two windows or by keeping one window and a door leading to the rest of the house open. One common fault in the heating of a house is keeping it too warm. The temperature should not be over 70 deg. Fahrenheit and during real cold weather the heat in a room will dry out the air. This can be remedied by placing some type of water container on the radiator.

Do not neglect a physical examination by your physician for a possible focus of infection. Infected tonsils, sinuses, teeth and nasal obstructions should be taken care of immediately. If the above measures have been carried out and you are still subject to colds, relief often can be obtained by receiving inoculations against colds. These inoculations will increase immunity to respiratory diseases, and are usually good for about one year.

POLICIES AND PRACTICES

A Letter to the Editor

OFFICE OF THE BUSINESS MANAGER
LABOR TEMPLE
SALT LAKE CITY, UTAH

MOTION PICTURE PROJECTIONISTS
LOCAL 250
of
I.A.T.S.E. & M.P.M.O. of the U.S. & C.
AFFILIATED WITH
AMERICAN FEDERATION OF LABOR
PHONE WAS. 4011.

Mr. James J. Finn,
INTERNATIONAL PROJECTIONIST,
New York, N. Y.

DEAR Mr. Finn: My attention has been directed to an editorial in a recent issue of a certain trade journal in which it is attempted to convey the impression that you are trying to dictate policies to our organization by using your extensive influence with many local units. The inference contained in the aforementioned editorial is unmistakable: it refers to you, or I just can't read English.

I admit that you have gained much prestige among the progressive local unions, and that you do exert considerable influence within these units. However, I have yet to note your having exercised this influence except as a constructive force.

If you have proven the existence of a number of people who wear hair shirts through having given the news as you saw it, or if you have been steadfast in demonstrating your honesty, courage and sincerity in your publication work, then you are to be envied rather than criticized. Your editorials have never gone in for boosting "fresh air and sunshine"; you go after tangible matters and leave the intangibles to the less courageous.

Contrasting Policies

Your conduct at the I. A. Convention in Columbus was exemplary. You made no attempt to commercialize your visit, but simply covered the Convention as a reporter for your publication—which, I think, is as it should be. I distinctly recall several subscriptions being offered to you, only to hear you ask that they be mailed to your office, since you weren't "at the Convention to do business" but merely to meet your friends. If you think that this fine impression, enhanced by contrast, was lost on the boys, you are mistaken, as I heard it commented upon several times.

It was noticeable that the person who now charges that you are trying to dictate policies, lost no opportunity to cash in on his visit to Columbus through the medium of a stall at the hotel headquarters and another at the Convention Hall. With you it apparently was more a matter of sentiment than of ready cash, since it is not to be doubted that you could have done exactly the same thing. As it was, your publication enjoyed an extensive distribution—and at no charge!

I condemn the action of any publication in utilizing an extract from the official Convention proceedings on its front cover, the extract purporting to be an official endorsement of the publication in question. Even our official proceedings are not safe from commercialization.

What a pity it is that an aggressive and courageous personality like yourself has to be subjected to unwarranted criticism of the sort mentioned previously. Still, there is some consolation to be had from the knowledge that few people these days go in for fighting phantoms. There must be something terribly real and alive about you to evoke such criticism.

'Dictation' Charge Ridiculous

The charge that you are attempting to dictate policies is ridiculous. All executives avail themselves of advice which they believe to be reliable. As for the statement that you are never asked for advice, in my National Safety Council work and as Regional Vice-President of the P. A. C. I have had the benefit of your aid on many occasions. Also, I can name offhand a half dozen local unions which appealed to you for data—particularly on fire prevention, fake projectionists schools, and the new aperture —and enjoyed your help. These locals were not too proud to appeal to you; and you were not too busy to help. Your distribution of the screen image chart on the new standard aperture was an outstanding piece of work—over and above the services you are expected to render for the subscription price you receive.

And I can think of other matters in which you extended powerful aid to various local units—concerning which I need not go into detail here. The boys will understand, however.

Your educational and socialization work for the entire projectionist craft has been of a high order, and I hope you will be available for such work for a long time. This letter is written not in any controversial spirit but merely because of a desire on my part to back up one who does the good work you do.

GEORGE A. YAGER,
Business Manager,
Local Union 250,
Salt Lake City, Utah.

OCCUPATIONAL HAZARDS OF THE PROJECTIONIST

EXPOSURE to apparently trifling concentrations of nitrogen-oxide may lead to profound edema of the respiratory tract. The word "edema" refers to swelling in the lungs and the respiratory passages because of the inhalation of nitrogen-oxide fumes. This swelling is so great and is so sudden in many instances that it causes internal suffocation.

Carbon tetrachloride is used in fire extinguishers in projection rooms because of the fact that it is a non-conductor of electricity, but when a carbon tetrachloride is played upon burning film it creates a very dangerous gas by combining with the nitrogen-oxide gases formed by the burning film.

Effect of Gases

These fumes lead to inflammation of the respiratory tract, to pneumonia, to narcosis, and if the exposure is prolonged, to degeneration of the liver, along with nephritis. Of course, you all know what pneumonia is.

Narcosis refers to the condition of being overcome by exposure to the gases generated when carbon tetrachloride is used as a fire extinguisher. The word "narcosis" is applied to any condition in which there is a loss of consciousness because of the toxic effects of various gases and liquids; we speak, for instance, of "chloroform or ether narcosis" for an example.

Nephritis is Bright's Disease or a definite inflammatory process in the kidneys. Other very definite vocational diseases of commoner occurrence but less direct in the production of physical impairment are:

Other Ailments

1. Damage to the eyes from the intense glare of light reflected from the surface of the motion picture film, at times direct exposure to intense light.
2. Excessive temperatures.
3. Frequently, but not always, continuous poor ventilation, even in theatres in which ventilating systems are installed.
4. Lead-poisoning.
5. Tuberculosis, caused by the inhalation of the fumes from burning carbons, which transmit free silica in large quantities to the projection room unless piped from the room by forced draft.

Notice!
Your opinion on the question of waxing prints is important. Why not send in your comments now?

MOTION PICTURE TECHNICAL PROGRESS

(*Continued from page* 15)

persensitive panchromatic . . . film negative is a material of Type *C*.

The current tendency is to photograph from one angle and to return, as far as possible, to the photographic technic of the silent picture. Generally, a scene is shot in an introductory long view, and then closer shots are made individually. There are fewer attempts to obtain simultaneous individual close-ups, and fewer cameras are used, the trend being towards single-camera shooting even in major studios, with rarely more than two cameras in use. This procedure is better for recording sound, as it necessitates less moving of the microphone and, at the same time, is more economical of labor and material.

Moving shots are somewhat fewer, but more effective; enthusiasm for constant movement of the camera has abated. Crane shots, which afford greater flexibility of movement have, to a considerable degree, supplanted "dolly" work on the stage floor.

Lenses, Shutters, and Apertures.—Perhaps tne most important advancement of the industry has been he promulgation and general acceptance of dimensional standards for the apertures of cameras and projectors.

One of the most interesting innovations that has appeared during the past six months has been a camera objective of adjustable focal length—the so-called "zoom" lens. The novel feature of the new outfit is its mechanical construction, which permits the objective to remain in focus while varying the magnification; the diaphragm opening varies at the same time with the focal length so that a constant *f* value is maintained. It is claimed that the Varo lens gives range of magnification, speed, and other features, while yet assuring critical definition at any point along the "zoom," as it is called. The lens consists of three moving elements, comprising a total of seven glasses. There is claimed to be no astigmatism or chromatic abberration.

A new form of high wattage incandescent lamp has recently been developed, in which the filament is supported directly by the prongs held in the socket, thus substituting metal-working precision for glass-working variable. The bulb plays no part in supporting the light source, merely serving as an envelope for the gas.

Composite Processes.—In the field of composite photography, the principal developments have been directed toward the perfection of the projection process. Instead of employing a special camera and differential lighting for producing the desired background, this method utilizes a technic in which the background is projected on the rear of a translucent screen, and then conventionally re-photographed with the foreground action. This is, of course, a well-known technic in still photography, and is by no means new in the motion picture field. Its present use has been broadened by the development of high-intensity light sources, synchronous electrical interlocks, and super-sensitive film emulsions.

The principal advantages of the projection method are greater simplicity and lower cost. It is possible to see the background as the screen is photographed; whereas in the traveling matte and transparency methods, other means of judging the success of the photographic composition must be used.

There is a tendency toward broaden-

? ? ? ?

Have you submitted your opinion on methods of film lubrication, as discussed in the article on page 7 of this issue? If not, do so now!

ing the band of frequencies recorded and reproduced. Where formerly results were considered satisfactory when a range of, say, 60 to 6,000 cycles was covered, the tendency now is to extend the range to a slightly lower limit at the one end, and to embrace considerably higher frequencies, up to, say, 10,000 cycles. The frequencies of recording galvanometer and valve peaks, formerly set approximately at 6,000 cycles, are being increased to about 9,000 cycles. Similarly, efforts are being made to extend the range of reproducing loud speakers, microphones, etc. Change of cavity shape and streamlining of condenser microphones have effected a substantial improvement in pick-up quality on the set.

Utilize Selenium

An Austrian reproducing machine is reported, which employs a tape record printed on glossy paper, the recording being done by the variable width method, with slit and selenium cell. The relatively high output of the selenium cell simplifies the amplifier requirements.

Processing Technic.—There has been a marked increase in the use of sensitometry in motion picture development, especially the development of picture negative. Three of the largest studios in Hollywood have established the practice of developing all picture negatives to a fixed gamma. This practice at first caused confusion among cameramen, but after becoming familiar with the laboratory technic, they adapted themselves readily to the situation. Sensitometric control of the negative is said to reduce the cost of development and produce a product of high average quality. A British patent has been granted a method of rendering the sound track area smooth on a film having embossed striations.

Film Treating.—A French patent No. 692,800 describes a process for protecting film and emulsion surfaces, comprising a coating of a thin layer of a transparent material having 4 parts of cellulose derivative and 96 parts of amyl acetate or other appropriate solvent. The practice of waxing sound film prints is being abandoned by some producers in favor of a protective coating to the emulsion and film.

Recently the lamp manufacturers have found it possible to make a commercially satisfactory lamp employing what is known as the bilpane construction. This form of light source is made by placing an aditional row of coils behind the front row, the rear row being so placed that its coils cover the spaces between the coils of the front row. Thus, an almost solid incandescent surface is presented to the optical system, resulting in a gain of 25 to 30 per cent in screen illumination over that obtained with the monoplane-mirror system.

The Bausch & Lomb Optical Company, of Rochester, New York, has recently made available a new 35 millimeter film slide projector. One interesting feature of the projector is that the mechanism for holding and operating the film is not connected in any way to the lamp house and condenser except in being mounted on the same base.

Sound Picture Reproduction

The first 16 millimeter sound-film projector has very recently appeared on the market. It is claimed to show a good 4 by 6 foot picture with excellent quality of sound reproduction.

Electrical Research Products, Inc.,

announces a double film attachment that has been designed for use on the Simplex head in projecting previews from working prints when the picture and sound are on separate film. This attachment embodies a take-up reel for the picture film and a pay-out reel for the sound track, both interposed between the picture and sound apertures. It is readily mounted in place of the blank plate at the back of the Simplex head.

Extended Frequency Range

The tendency in reproducing sound on film is to extend the frequency range so tht the higher frequencies are radiated from the loud speakers. Both RCA and ERPI are about ready to introduce this so-called wide band reproduction into the theatres.

Electrical Research Products, Inc., has developed a tool for use in accurately adjusting lens tube assemblies in W.E. sound-film reproducers under actual reproducing conditions in the field. This tool enables the average man to make a more accurate adjustment than was possible by the most skilled man using the older method.

A new photoelectric cell is announced which requires no auxiliary voltage. Increased use is claimed for selenium cells in sound film projection. These cells were developed by Dr. Thorring and are claimed to be 1,000 times as sensitive as gas-filled photoelectric cells.

Storage batteries are now being eliminated from Western Electric sound equipment, being replaced by rectifier-filter units. The design of these units adapts them to any type of existing or new installation that would otherwise require storage batteries.

Improved Disc Recordings

A marked improvement in disk sound records is reported from the Bell Telephone Laboratories. The Laboratories claim that both theoreical and experimental investigations indicate that a phonograph record, cut with vertical undulations instead of the more usual lateral undulations, possesses fundamental advantages. The principal improvement is a marked increase in the volume and frequency range over which faithful reproduction may be obtained. A higher volume level can be recorded using the same groove spacing and speed. A greater playing time can be provided, with a given volume level, by a record of given size, since for these conditions, both the groove spacing and the speed may be reduced.

Improvements in methods of processing the stampers and in the record material result in a large reduction of the surface noise and hence a corresponding increase in the volume range. With these improvements, the frequency range that can be reproduced satisfactorily can be extended nearly an octave, to 8,000 or 10,000 cycles. Incidental to these features are the great improvement in the quality of reproduction obtainable directly from the soft "wax" record and a

great increase in the life of the hard record.

Propector Lenses and Optical Systems.—The Bausch & Lomp Optical Company has designed a lens of 1 inch focus and a relative aperture of *f*/2.5 for the projection of standard 35 millimeter film. This is of interest, principally, for projecting film behind a translucent screen. The lens requires a condenser mounted immediately behind the aperture plate of the projector in order to obtain uniform illumination of the field.

Burt describes an optical system that uses positive and negative cylindrical lenses having their axes at right angles. The image of a source is optically elongated and flattened by these cylindrical lenses to the proportions desired, and is then focused on the film. Advantages are: maximum possible brilliancy with a given source temperature; insensitivity to the position of the lamp filament; sharpness of the image; and perfectly uniform brilliance throughout the length of the beam.

Special Projection Methods

Effect Projection.—According to H. Picard, a wide screen picture can be obtained with film of normal width by compressing the width of the image by using an auxiliary cylindrical lens both in making the negative and in projecting the positive. This method is open to the objection that the graininess of the negative is evident in the magnified image of the positive. It is proposed to overcome this fault by using wide negative film and compressing the image with the auxiliary lens in the process of printing by projection on the fine-grained positive.

Other applications using this scheme are mentioned, such as that of producing narrow vertical pictures, and color and stereoscopic processes requiring two or more pictures in the standard frame.

Stereoscopic Projection.—H. E. Ives has considered the problem of projecting motion pictures in relief, summarizing as follows:

"The essential conditions for produc-

ing pictures in stereoscopic relief are twofold: first, separate pictures must be made from different points of view, corresponding to the two eyes; second, each eye of the observer must receive its appropriate view. No compromise with these fundamental requirements appears possible."

Non-Intermittent Projection

A new type of non-intermittent motion picture projector is described by Huc. The principal involved is one that requires the film to pass over a cylindrical drum having an aperture through which the single frame or picture is projected upon an oscillating mirror which, in turn, reflects it into the objective of the machine.

During the movement of the film over the aperture, the adjacent frame is isolated by means of a movable window behind the aperture, which moves at the same angular velocity as the film. When the projection phase is terminated a shutter masks the objective during the return of the mirror and window. It is claimed that such a projector is capable of projecting a film 3,000 times without injuring it.

Theatre Acoustics and Construction.—A series of interesting articles dealing with theatre acoustics and construction have recently appeared, a few of which are abstracted briefly here.

E. Petzold advocates the regulation of the acoustics of an auditorium just as its lighting and heating are regulated. He explains a method by which the change in acoustical absorption caused by the presence of an audience may be compensated for. He describes acoustical controllers consisting of a series of rotatable triangular columns, the walls of which consist of three types of materials: reflecting, absorbing, and resonating.

According to Hopper, the necessity of determining acoustical coefficients of absortion at frequencies up to 8,000 cycles has been brought about by the improvements being effected in increasing the frequency range of recording and reproducing sound pictures and in radio broadcasting. Naturalness and intelligibility are enhanced by the addition of these higher frequencies, which further increase the effect of realism.

Theatre Reverberation

According to Friend, the audience affects only the reverberation time. It is desirable to maintain the reverberation constant, a difficult feat under the varying conditions of the audience. Such a condition may be approximated by using seats of sufficiently high acoustical absorption that the total absorption will remain nearly constant whether the seats are occupied or not. Some other general rules concerning acoustics are mentioned. Among these are: the importance of avoiding curved surfaces that can focus the sound, the necessity of proper balance between the size of the room and the sound output, and the avoidance of unusual shapes that make satisfactory distribution impossible.

Color Photography

The growth of a color consciousness is evident in the motion picture industry, and comes as a welcome departure from the recent period during which little interest in color was evinced by the producers. Since the last meeting of the Society, one feature comedy drama has been released in color, a mystery drama is now in production which promises to be enhanced by the additional dramatic effects available, a number of short subjects both for amusement and advertising have been released to an approving public, and additional subjects now in the form of negatives are awaiting printing.

Adequately faithful reproduction in color postulates processes that are inherently stable throughout the several steps of manufacture on a scale yielding in a short time a large number of prints of uniform quality in color balance, register, contrast, definition, and sound reproduction. Material advance is reported along these lines, notably by Technicolor, whose improved printing process has produced a uniform product having little apparent graininess, and showing good long-shot definition.

Technically, no fundamental developments of importance in color photography have been disclosed during the past six months.

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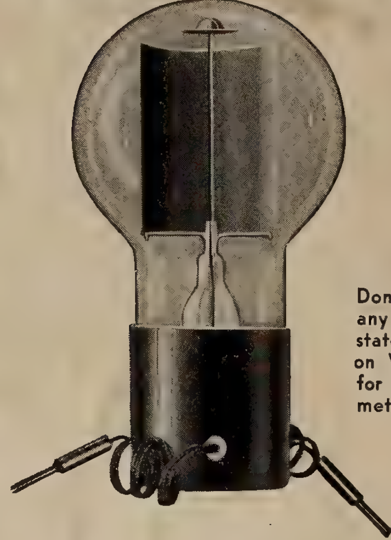

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MONTHLY CHAT

MR. M. D. O'BRIEN, genial and efficient assistant director of projection for Loew Theatres, Inc., has been slaving away through the hot summer months on an inquiry into the various electrical codes of these 48 states, in addition to Canada, his avowed aim being to sponsor in print an exposé of the conflict existing between these various codes and that code promulgated by the National Board of Fire Underwriters.

Dame Fortune and the exigencies of directing projection work permitting, the first of a series of articles on this topic by Mr. O'Brien will appear in our next issue. Accuse us of holding forth bait or what you will, the fact remains that the series will make engrossing reading.

THE new Bausch & Lomb condenser system, concerning which not nearly enough has been said, is delivering simply swell results on high intensity equipment in those theatres lucky enough to have secured the set-up. A 50 per cent increase in light is an accurate statement of results obtained through use of this B. & L. system.

COMMENT by Sidney Wein (N. Y. City), on the exciter lamp story which appeared in our July issue: "A great story in itself; but is there a projectionist worth his salt who isn't aware of the truth of the statements made by Mr. Farnham? This article should be reprinted and distributed generally among exhibitors, service men and engineers (?)" (the question mark is Wein's), "who give out advice on exciter lamp operating current values that would make a schoolboy lift his eyebrows. . . . Well, I suppose economies must be talked about, even though they are not actually effected."

Thanks, Mr. Wein. But you overlooked the reason for publication of this story, which was to provide the projectionist with enough rounds of ammunition to bring down even the most insistent manager or owner, or most conceited engineer (?).

THE Academy of Motion Picture Arts & Sciences has returned to the wars. Recently it organized a "Research Council" which will look into "theatre and exchange practices" having definite bearing on film mutilation. We wish the Academy luck, which is the very least we can do in view of its spendid work in connection with the S.R.P. and the uniform aperture. In defiance of that oracle who recently proclaimed that "gratuitous advice is always pitiful" we proffer two suggestions: (1) that the Academy not wait too long this time before availing itself of advice from practical projection men, and (2) that once discovered the problem be attacked by rulings *with teeth in them*, as contrasted with the policy of reliance upon the weather or upon the frailty of human nature.

INTERNATIONAL PROJECTIONIST

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AUGUST 1932

RECENT IMPROVEMENTS IN SOUND SYSTEMS

By The Onlooker

IMPROVEMENT in sound reproducing equipment has gone forward steadily since its earliest days. The projectionist who was concerned with sound at its very beginning must sometimes stop and rack his memory before he can recall that some method of operation or article of equipment which he now takes for granted was *not* present when sound began. How many of us bother to remember now that sound-on-film was seldom a part of the first commercial installations?—or that the most impressively important part of an early sound system was often the non-synch?

Noiseless recording is only about two years old and yet seems so far in the past that most of us, when by accident we hear an old, noisy print, wonder why people ever paid to hear such things.

Improvements of the present moment are concerned chiefly with two problems: (1) increasing the range of frequencies reproduced, and (2) the elimination of batteries as a source of power. These are not the only improvements now under way; they are only the most prominent. There are many others, some small, some important, so various that it is impossible to classify them; they are best described one at a time without regard to any regular order.

Although most earlier radios, and many of the present day, were and are deficient in the reproduction of the lower frequencies, few theatre sound systems have ever been afflicted with that particular trouble. From their inception theatre sound systems employed properly designed circuits, adequate speech transformers, and either cone speakers or horns large enough to handle low frequency sound. The higher pitched sounds were cut off, and some still are. Many of the earlier discs could not produce more than 4,000 cycles, and the first sound-on-film systems were not a great deal better.

Writing under the pseudonym of "The Onlooker", one of America's best-known projection men gives free and full expression to his views on recent developments affecting sound picture reproducing equipments.

The disc has been improved by substitution of the hill-and-dale method of recording for the older, lateral method. In the old disc, the needle moved from side to side to pick up the sound recorded. In the newer method—not so new, since Edison used it years ago in his phonograph—the needle moves up and down. Among its other advantages, the hill-and-dale method makes possible the reproduction of higher frequencies. Broadcasting stations have taken full advantag of it for their "canned" programs. It has not been introduced into theatre work because the disc is no longer of great importance to the theatre; it is merely ready whenever theatre business thinks it needs it.

High-frequency response from sound-on-film, however, has steadily improved. For some time the stumbling-block was the lens assembly by means of which the exciting light is focused on the sound track. It is obvious that if a change in the sound-track .001″ in height is to be reproduced with full effect, the exciting light must be focused down to a beam not more than .001″ in thickness. This improvement was made some years ago.

A change in the sound track .001″ in height represents a frequency of 9,000 cycles. This is easily understood. The film moves at 90 feet per minute, or a foot and a half, or 18 inches, a second. It takes two complete changes to represent a cycle—one change is an alterna-

tion and only two are a cycle. Therefore, two complete changes in 18 inches, one change in 9 inches, would represent one cycle per second. Nine changes in 9 inches, or one change in one inch, would represent 9 cycles per second. A thousand changes in one inch, or one change in a thousandth of an inch, would represent 9,000 cycles per second.

Some three years ago the exciting lamp focus was improved to make 9,000 cycle-sound a possibility. Today, recording apparatus has been improved to record such sound. The stumbling-block now is the loud speaker, few of which now in use can reproduce more than 6,000 cycles, and many cannot go that high.

One present-day improvement,* of which much will be heard in the near future, is the introduction of supplementary speakers capable of reproducing sound of from six to nine thousand cycles. Often a larger number of high-frequency than low-frequency speakers will be needed, because the high frequencies travel in straight lines and do not spread, and it is difficult, with a few speakers, to distribute such sound evenly over the area of an auditorium.

Very often this improvement will require minor modification of an amplifier or other portion of the speech circuit. As long as the speakers limited reproduction to 6,000 cycles, there was no reason to build amplifiers or plan circuits capable of greater response, and some are not. The changes they will require to enable them to carry the higher frequencies will vary with the type of system, but seldom will they be very drastic. In most cases replacing a transformer, or the addition or removal of a condenser or a resistance, is all that will be necessary.

Nine thousand cycles is higher than the tone of any human voice, or the fundamental pitch of any instrument. Such frequencies carry only the overtones, but it is precisely the overtones, or harmonics, that are important toward distinguishing instruments or identifying voices. Addition of those three thousand cycles makes an astonishing improvement in the seeming naturalness of the reproduced sound.

All-A. C. Operation

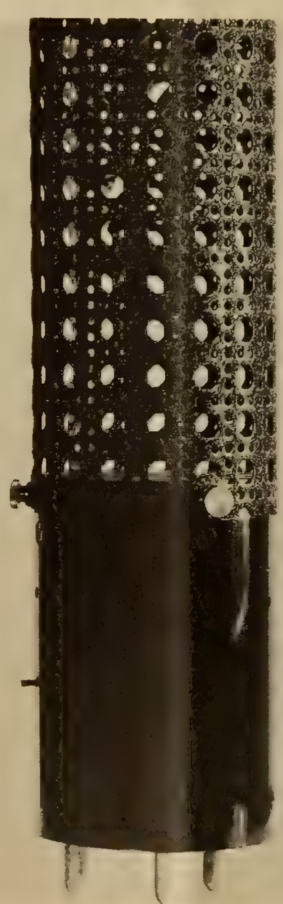
The elimination of batteries is a pressing question at the moment. The reason for this is doubtless that batteries wear out, and therefore a new set or an eliminator of some kind must be purchased in any event.

The question of whether eliminators are really preferable to batteries in every respect is open to debate. Theoretically, the battery is quieter. Actually, all-A. C. operation yields perfectly quiet sound. In most cases, an eliminator of any kind costs more than a new set of storage batteries, especially when the cost of installation is considered. On the other hand, the eliminator will not wear out in a few years. The eliminator generally uses less current than batteries do, especially when the batteries are aging; but the eliminator, if it is a rectifier, often uses tubes.

In the absence of exact figures as to comparative costs—and if these exist, they are not known to the writer—the debate seems to have been settled by the decision of all important manufacturers to bring out only A. C.-operated equipments. Theatres, however, are still buying replacement batteries, and in each individual theatre the exhibitor or the projectionist must settle this issue of batteries *versus* eliminators on the grounds of their own conditions.

Eliminators are of two general types—the motor-generator and the rectifier. Each is supplied with a "ripple" filter. Each has been used since the earliest days of sound. Only a very small number of sound systems were even completely supplied by battery power.

The rectifier is built into nearly all modern amplifiers and supplies the plate current for the amplifying tubes, the filaments of which are often lighted by raw A. C. However, many amplifiers now in use are so designed that the filaments of some or all of their tubes, and especially of their smaller tubes, must be supplied with direct current. This current was drawn from storage batteries, and it is those batteries that are now being replaced by rectifiers.



Adapter which permits the use of a mercury vapor tube in place of the 219-D. A slight circuit modification is necessary

In a few instances, as said, the plates of amplifying tubes also were supplied from storage batteries, rather than by means of a built-in rectifier. Eliminators to replace storage plate batteries are available and are now being used.

Eliminating Batteries

There are three existing methods of eliminating the storage batteries used to supply the exciting lamp. One is by means of eliminators. Another is to light the lamp with A. C. and then include in the sound circuit a filter that will eliminate the resultant hum from the sound as reproduced. The elimina- of one frequency of, say, exactly 120 cycles will make no difference in the sound that anyone can hear. A third method, not much used in theatre practice but growing in popularity for portable equipment, is to light the exciter filament with a higher frequency generated by a special vacuum tube circuit. The filament temperature of the lamp cannot respond to current changes of the order of 1,000 cycles, and therefore no hum is created.

There are two present methods of eliminating storage batteries that supply the loud speaker fields. One is an eliminator built for the purpose. Another method is to draw direct current from the arc-source and step-down the voltage through resistors. A moderate ripple in the speaker field circuit has no audible effect upon the sound, and this second method is popular because of its cheapness.

"B" batteries used to polarize the photo-electric cell, and for plate supply of small vacuum tubes, can be eliminated by drawing on the plate supply of the system amplifier, stepping-down the voltage by means of resistors, and adding a ripple filter. This system is built into some of the newer types of equipment and, it is expected, will soon be introduced as a modification to systems already in use.

Projectionists should familiarize themselves with rectifiers and their operation, as a type of equipment likely to be added to their responsibilities at any day.

The rectifier—as distinguished from the filter often built-in with it—is of either of two types. One type is the familiar two-element tube. It contains a filament and a plate. (If a three-element tube is used, the grid is shorted to the plate at the socket, and inoperative.) Electrons are emitted from the heated

* Editor's Note: Erpi's trade name for this improvement is "Wide Range"; RCA's equipment is designated "Extended Frequency Range."

filament and travel to the plate, constituting a flow of current which moves, as does all current, from negative to positive. The electrons, being negative, are attracted to the plate only while that is at positive potential. If a source of alternating current is connected to the plate, current will flow only half the time, and always in one direction.

If two such tubes are connected in a "full-wave" circuit, a fairly continuous flow of current can be obtained, but always in one direction only.

Another type of rectifier depends on the action of a series of copper-oxide, or copper-sulphide, metal discs. The reason for the rectifying action of such arrangement is unknown. It will, however, transmit current in one direction only. Sets of such discs are connected in a full-wave circuit, just as tubes are. The working portion of the discs is always hidden beneath the fins that are arranged to carry off and radiate the heat of their operation.

The filters for either type of rectifier —or for a motor-generator used to supply direct current—are always an arrangement of choke-coils and condensers. If properly designed, they should never give any trouble. If skimpily designed—or if overloaded when designed properly —the condensers may short-circuit or the coils burn out. Since arrangements of this type are included in all modern amplifiers, most propectionists are tolerably familiar with them.

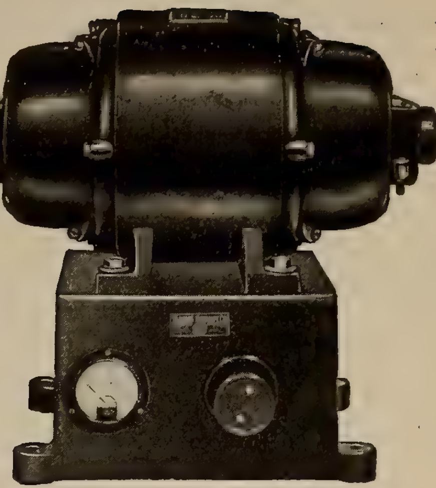
Rectifier tubes burn out like any others—or wear out, depending on the type of the filament. Mercury vapor or argon-filled tubes are sometimes used in sound rectifiers. Their use requires some modifications in the design of the associated apparatus, but should cause the projectionist no trouble—he need only treat them like any other tube. They generally have a longer life than the vacuum types.

Copper-oxide "stacks" have an indefinite life, if enough of them are used for the currents they have to carry. It is difficult to say how long they may be expected to last—life tests made by some manufacturers have been going on for several years and still are incomplete because the rectifiers still are working. However, these discs are expensive, and some rectifiers now on the market do not use enough of them. And the stacks are hard to obtain—usually they are made to order—so that rapid replacement cannot always be counted on. The question of stacks *versus* tubes for rectifiers is therefore very far from being settled.

Mercury-Vapor Substitutes

Mercury vapor rectifier tubes are generally cheaper and smaller than vacuum tubes used for the same purpose. One important manufacturer is now prepared to rewire a plate-supply rectifier panel

Top: Esco type H 183 converter, with filter. Right: Esco converter with meter, rheostat, and filter, in special base



to allow the use of mercury-vapor tubes in place of the older, far more expensive, vacuum rectifier tube.

A large chain of theatres using many of these panels has developed a simpler method of modification, consisting of an adapter to be placed in the rectifier tube socket. The adapter contains the necessary modifying apparatus, and the mercury-vapor tube is plugged into the adapter. This device is not yet commercially available to theatres outside the chain which developed it. The panel modification, which is a more expensive method of attaining the same purpose, is made available to any theatre by the manufacturer of the panel in question.

Non-Shimming Adapters

The fact that in many of the older types of equipment the projection head must be shimmied up to make its gears mesh properly with those of the "sound attachment" has led to the development of a "non-shimming device." This contrivance substitutes a pair of adjustable gears for the shims, and makes changing a head a simple job of only a few minutes. In practice, however, the non-shimming device has shown some tendency to bind up, and in a few instances has stopped a show. The projectionist who is contemplating the installation of a device of this kind should study it, therefore, with particular attention to its probable wearing qualities.

Steel Gears

On "sound attachments" of at least one type bronze drive gears are now replaced by bronze gears surfaced with steel. The latter last far longer and cost no more; they are therefore a very much better investment. In consequence, projectionists may feel less hesitant than formerly in the matter of replacing bronze gears of this type which are showing marked signs of wear. Formerly, it was felt to be good business, in some theatres, to retain worn bronze gears in use until the last moment the safety of the show would allow, and perhaps even a few moments beyond.

The fact that the steel-faced gears are by way of being a "bargain"—in the sense of having a far greater life—should help induce projectionists and exhibitors not to risk their show unduly by retaining bronze gears in use past the point of danger.

"Safety" Tubes

The most conspicuous and almost the most important improvement in tubes in recent years, was the introduction of the "non-microphonic" small tube for use in photo-electric cell amplifiers and the earlier stages of power amplifiers. A more recent and far less dramatic, but infinitely more important, improvement is the introduction of tubes of this type that *do not burn out.* They are now everywhere available, and the projectionist should see that he gets them when he orders tubes.

The filament becomes inoperative as it grows old, the volume of sound gradually decreases, and the projectionist, searching at his leisure for the cause of the slight drop in volume, tests his tubes and removes the bad one. What was perhaps the worst of all menaces to the continuity of the show is removed by the use of this tube. It costs no more than the other kind—the writer cannot see any excuse for using any other kind.

Public Address Systems

The use of the public address system in theatres has grown significantly in recent months. Most large theatres using vaudeville or stage presentations, and many smaller ones, are using P. A. to reinforce the voices of the performers. In such cases the P. A. is not used at full volume; good showmanship dictates that the audience be kept in ignorance of its presence. As most often used, it seems to be an inconspicuous prop rather than a visible part of the show, but a

prop none the less important for being hidden.

In some houses the same or another P. A. system is used for ballyhoo over the box office or in the lobby.

The similarity of public address apparatus to the equipment used in sound systems would indicate that the projectionist, with his wide experience with the latter, is the proper man to be intrusted with the care of the former. In some theatres, of course, the stage crew may dispute such an arrangement. Any dispute of that kind must, naturally, be settled on the basis of local conditions. In the majority of theatres the public address system, if it exists at all, will necessarily be under the charge of the projectionist.

Public Address Systems

Many sound systems are equipped with microphones and thus are in themselves public address systems also. There is also an arrangement for connecting a box-office loud speaker with the sound equipment, and using the picture to ballyhoo itself—and such an arrangement can be installed anywhere it is felt to be desirable.

The public address system, essentially, is a microphone or electric phonograph as the source of sound, an amplifier of suitable power, and one or more loud speakers. If several microphones are used a "mixer" panel should be added. The mixer contains a "constant impedance" volume control for each microphone—an arrangement of resistances by means of which the volume from each microphone is varied while the impedance of the line remains always the same. There is usually also an over-all volume control of the same type, which modifies the total volume as needed.

Microphones of the condenser or the new moving coil type may be used when perfect quality is desired. The condenser microphone has a very low output, and a small amplifier is therefore built into the same shell-like case.

Some sound system manufacturers also supply public address systems. Public address systems can be bought on the open market, from manufacturers of radio equipment at prices generally lower than those prevailing for most types of theatre equipment. Although they are most commonly all-A. C. in operation, a few use storage batteries.

The projectionist who is familiar with the principals of his sound equipment will not hesitate to add the care of P. A. system to his responsibilities; and they seem, as has been said, to be coming into increasing and widespread favor in theatres of every type.

Improved Technique Lends Impetus to Color Photography Art

THE development of color cinematography is proceeding vigorously in various countries, and it would seem that 1932 will witness many contributions to the art, in sharp contrast to the dearth of such activity during the preceding year. Among the notable contributions to color cinmatography of late are the experiments carried out by Multicolor Film, Inc., of California, details of which are incorporated in U.S. Patent 360,819.

The Multicolor system is especially adapted to the colored sound film. As is common knowledge, one of the principal difficulties hitherto encountered in the realization of this type of film was the fact that coloring of the sound strip easily caused acoustic distortion in the reproduction. According to statements by Multicolor, the acoustic reproduction suffers when the film is colored with red coloring material, while no such ill result derives from the use of blue coloring material.

Multicolor Process

A normal negative is used in the Multicolor process for the sound registration, which is made with a constant intensity on a lateral strip of the width of about 3 mm.

In the colored positives obtained by the systems where the black and white pictures were afterwards colored by absorption or tinting, the sound section remained in black. With the new method, the sound strip also is colored by means of a special chemical process. The invention therefore amounts to a new process for the preparation of a colored film, the sound strip of which is colored at the same time.

Treatment of Positives

By this system one of the partial positive copies, both optical and sound sections, are colored in blue, while only the optical strip of the other partial positive copy is colored in a complementary color. Naturally, the process requires two partial negatives, one of which is made through a blue screen and the other through a red. The resulting positives are colored in the complementary colors, that is to say the first in red, and the second in blue. The sound registration is made exclusively in taking the partial negative with the red screen filter. This is printed in positive and then colored in blue.

It should be noted that the colored partial emulsions can be placed both on the same part of the celluloid support, instead of one on one part, and the other on the other part.

Naturally, the chromatic results of this system do not greatly differ from those obtained by the usual bi-chromatic processes. The novelty consists essentially in the coloring of the sound strip, as has been pointed out.

ACADEMY RESEARCH COUNCIL TO CONSIDER STANDARDIZATION

Appointments of leading motion picture technicians to head sub-committees of the Research Council of the Academy of Motion Picture Arts and Sciences, to carry out projects instituted at its first meeting, held on August 15, have been announced by Darryl Zanuck, chairman.

The chairmen of the groups and the subjects they will investigate are: Virgil Miller, development of a noiseless camera for recording sound pictures; Carl Dreher, standardization of set and costume tints; John Nickolaus, uniform release print practice; W. C. Harcus, release print film processing investigation; C. Roy Hunter, film preservatives investigation; Douglas Shearer, screen quality study; E. H. Hansen, split-film recording investigation.

The Academy's Research Council was organized recently as the governing body for technical investigations and standardizations within the film industry. In addition to consolidating the work of previous Academy groups devoted to technical research, the new body will investigate technical problems affecting actors, writers and directors.

Among the more important activities of the Council will be an investigation of exchange and theatre projection practices which will be aimed at decreasing or eliminating film mutilation.

COURT AWARDS TO ERPI ON THEATRE CONTRACTS

In announcing court awards to ERPI against three theatres for back indebtedness and damages Electrical Research Products states that the company has no intention of wholesale legal action against exhibitors in arrears but that it would protect its interests by legal actions in cases where it was felt that a sincere effort was not being made to fulfill contractual obligations.

Liquidation Damages

The three theatres against which judgment was obtained, the amount of the judgments and the courts are as follows: Washington Theatre, Pittsburgh, Pa., $1,925.96, Court of Common Pleas, Alleghany County; Embassy Theatre, St. Louis, $6,749.22, U. S. District Court, Eastern District of Missouri; Crescent Theatre, Chicago, $2,641.98, Circuit Court.

A significant feature of the awards is the allowance made for liquidation damages, as provided for in the ERPI contract. This provision of the contract has long been a matter for speculation by lawyers within and without the motion picture industry.

ELECTRON-TUBE CONTROL FOR THEATRE EFFECT LIGHTING

THE International Music Hall now being built for New York's Rockefeller Center will be equipped with lighting facilities exceeding anything ever used in a theatrical enterprise. Greater and more spectacular stage presentations than any the world has ever seen will be produced in this new 6,100-seat RKO theatre under the direction of "Roxy" Rothafel, world-famous showman.

The lighting equipment for the entire theatre will consume 3,000 kilowatts —enough to run about 30,000 radio sets. There will be 314 lighting circuits—more than twice as many as there are in the Chicago Civic Opera House, which at present has the record number of circuits. The average theatre has about 50 circuits, and the average motion picture house has considerably less.

By means of special equipment designed for the International Music Hall by General Electric Company, all the lights of the stage and auditorium will be controlled by a lighting director from a small pit in front of the orchestra. Control of all lighting effects, including changes of color, variation in intensity, etc., will be at the finger tips of this man. The equipment, known as Thyratron reactor lighting control, is a most modern development, eliminating bulky backstage theatre switchboards and allowing the lighting director to take his place in the auditorium where he can see the effects he produces.

Variety of Lights

The lights subject to this control can be roughly divided into those for the auditorium and those for the stage. Four colors (red, amber, green, and blue) will be used in the auditorium lighting alone —a large variety for such a purpose. The reason for their use is that modern stage productions, no longer confined to the stage itself, have many effects extending into the auditorium.

An elaborate choral stairway and runways on each side of the auditorium will be among the architectural features figuring prominently in these effects. In the ceiling will be booths housing flood- and spotlights for the orchestra leaders, the orchestra, the organists, stage, etc.

All this auditorium lighting, in addition to its control by color, will be divided into groups controlled by function, such as the ceiling coves, balcony ceiling circuits, sidewall fixtures, organ grill, etc.

On the stage the color circuits will not only include red, amber, green, and blue, as used in the auditorium, but also a daylight color effect involving additional lighting circuits. This will create a new effect to be used on the cyclorama[1]. Heretofore blue and white were used to create a daylight effect for this purpose. Other important stage circuits will be the footlights, border, bridges, side portals, side bridges, stage pockets, revolving stage, side towers, trap pockets, etc.

The Lighting Control

The lighting control pit in the auditorium will have approximate dimensions as follows: 16 feet long, 6 feet wide, and 6 feet deep. It will be covered by a hood, making the occupants invisible to the audience. The lighting director will operate a lighting control board of the console type, while his assistant, by means of nearly 2,000 knobs, will be "presetting" light for at least four scenes in advance. The control board will also permit the introductions, in any of these scenes, of supplementary effects, such as sunsets or fire effects. This will allow at least ten lighting changes without resetting any of the circuits.

Each of the controls for the five preset scenes will have its individual scene master control. In addition there will be a control allowing the director to "fade" from one lighting effect into another without any change in the *weight* of the colors in either scene; i,e., one effect will diminish and the other will increase in intensity with a smooth and gradual transition from scene to scene. Finally, by means of a rehearsal control, it will be possible to set up and adjust scenes before they are preset on the five scenic controls. To facilitate the lighting intensity changes of any part of the scene, these rehearsal controls will be provided with group, color, and grand master regulators. The effects obtained in rehearsal will later be set up on the preset setting.

Electron tubes and specially designed reactors, installed in out-of-the-way places in the theatre, will be the foundation of all this new and extremely simple lighting control. The electron tubes, similar to those in radio sets but different in construction, are known as *thyratrons*, *phanotrons*, and *kenotrons*. There will be four installations of reactor racks and tube panels, one in the basement and three in the attic of the theatre.

Spotlight Control

For the first time in any theatre there will be Selsyn-operated control of the boomerangs on the incandescent spotlights. There will be 150 of these spotlights situated on the bridges, borders, side portals, and side towers, and in the ceiling of the auditorium. Boomerangs are the movable color screens (red, amber, green, and blue), any of which can be slid into place before a spotlight in order to change the color of light coming from it.

In the earlier days of the theatre, these

[1] The cyclorama is the backstage drop used to create a scenic atmosphere in outdoor settings.

The unorganized British projectionist, unlike his American brothers, trusts not to luck or to the weather in gathering data on his work. The British projectionist has learned the value of a purely technical society—which most American projectionists profess not to need.

THE GUILD OF BRITISH KINEMA PROJECTIONISTS AND TECHNICIANS, LTD.

Date as Post Mark.

The Monthly General Meeting of the above Guild will take place on Sunday, Feb. 7th, 1932, at 11 a.m. sharp, at the Western Electric Company's Demonstration Theatre, "Brooklyn Hall," Bush House (West Wing), Aldwych, W.C.2, by arrangement with Major G. Jacques and F. G. Humberstone, Esq.

There will be an Illustrated (Sound) Lecture by H. S. Hind, Esq., Technical Adviser to the Educational Dept. of Western Electric.

(*a*) The Masking Effect of Noise.
(*b*) Phase Distortion of Speech.
(*c*) Tone Qualities of Musical Instruments.
(*d*) Experiment of certain phenomena in the recognition of the pitch of musical tones.
(*e*) The Orchestra and its Instruments.
(A Series of Sound Films).

The above by courtesy of the Directors of the Western Electric Co., Ltd.

Yours faithfully,
C. HARTLEY-DAVIES, *General Secretary.*

N.B.—Admission only on production of Membership Card.

screens were moved into place by hand. Then magnets were used; and now, in the International Music Hall, Selsyns will do the work. A Selsyn is an electric device that transmits angular motion over electrical conductors. Thus, any movement at the control point is transformed into electricity and, at the point where it is needed, is again changed back into exactly the same motion as the original. The only connection between the control and the work is the wires conducting the electricity.

Technical Explanation

The technical explanation of how the lights are dimmed and brightened with the new system is as follows: One side of the voltage supply to each light or group of lights will pass through one winding (A) of a saturable core reactor functioning as a choke coil. The other winding (B) of this reactor will be fed by direct current from a *thyratron* and a *phanotron* tube. The variation in amount of the direct current effects the impedance or choking effect of the "A" circuit. The amount of rectified current ("B" circuit), supplied by the tubes will depend on the electrical relationship between the elements of each tube, and this relationship in turn will be determined by the presetting manipulations of the lighting director.

The sequence of operations can thus be briefly summarized as: (1) the lighting director manipulates his controls; (2) the elements of the tubes change their relationships; (3) the amount of rectified current supplied by the tubes varies; (4) the impedance or choking effect of the reactors varies; and (5) the voltage supply to the lights varies, thus uniformly varying the lights themselves from "blackout" to full brilliancy, or *vice versa*.

By manipulating the knobs on the individual circuits, the lighting director could control the lights, but this would involve the operation of a possible 314 knobs—one for each circuit. By the use of master controls it is possible either to govern all the lighting circuits through one knob, or to split the control into major and minor divisions of color, location, and function.

Fire Prevention Tips

In the projectionist's hands lies the security of a theatre audience. His watchfulness, care in handling inflammable and combustible materials and his ability to visualize the tremendous importance of his position are the measurements of the degree of protection against fire existing in his theatre.

EFFECT OF MOTION PICTURES ON THE EYES

Park Lewis, M.D.

[One of the most interesting aspects of motion picture projection is the question of the effect of motion pictures on the eyes. It appears likely that the near future will see a co-operative effort by medical and technical workers seeking to throw more light on this engrossing subject. The accompanying article by Dr. Park Lewis, a practicing ophthalmologist and one of the motivating forces in the National Society for the Prevention of Blindness, reviews some of the work already accomplished in this field.—EDITOR.]

IN order that we may the better understand the effect of the cinema on our eyes we must know something of the way in which outside impressions affect our consciousness. We are in fact seeing moving pictures from the time that our eyes are opened in the morning until they are closed at night. Either we are moving ourselves or somewhere within the range of our field of vision there is constant movement. It may be the flickering sunshine, the tremulousness of the leaves in the trees, the passing of flying birds, the fluttering of the garments of those who are near us, the vehicles in the roadway or any other of the constantly changing impressions that indirectly meet our eyes. These are of such continued occurence that we grow to ignore them. They nevertheless stimulate the retinal elements and we become at once aware of them as soon as we are conscious of their presence. The impressions of the objects that we regard as stationary are not as free from motion as they appear to be.

Action of the Eyes

Now, in fact, we are never absolutely still. Our eyes are continuously adjusting themselves to the changes in position which we ourselves assume so that if we are looking at a fixed object the image which it makes on our retinae can be fixed only if we are as still as the object of our attention. The head will move forward or backward, the body will sway to some degree even though we may be wholly unconscious of any motion. Moreover, any fixity of gaze for more than a very short time is fatiguing, so we almost automatically and unconsciously look from one detail to another.

Nor do the eyes move from point to point with a continuous motion. In reading, the eyes follow the lines in a series of jerks, the interval between these allowing the image to be received on the nerve endings and recorded before the next rapid motion is made. In stereoscopic vision when both eyes are working together to produce a single impression all of the external motor muscles that control the action of the eyeballs are brought into play. When the object on which the gaze is fixed is itself in motion the interplay of coordinate action is almost inconceivably rapid.

Consider for a moment the muscular activities that are necessary to maintain the harmonious, balanced action of the eye muscles in the driving of a golf ball or, to a still greater degree, in a great baseball batter like Babe Ruth who fixing his attention on the pitcher, must anticipate the kind of a ball which will be thrown.

Retinal Impressions

The interval that elapses between the time that the ball leaves the pitcher's hand and its arrival over the home plate is measured in fractions of a second, the ball being propelled with the velocity almost of an arrow, before it can be struck. In that almost incalculably short period, he must so direct all of his muscles including those of his eye as to enable him to strike the ball at the chosen distance from the end of the club to give it its driving force, to strike it with the center of the curved surface and not with an edge and to determine the exact direction in which he wishes it to go. This combination of muscular actions becomes in time automatic but they are all unconsciously controlled by the definite even though subconscious impressions that that flying ball is making on the player's retinae.

The moving pictures that meet the eye as we walk along the street differ in several respects from those that are usually shown in the cinema. Often we and the objects that we pass are both in motion. Indeed, as we have shown, in some measure this is always so. If, however, the objects are at some distance from our eyes, the angle which they form on our retinae is a long one. The longer this angle is, the slower the sense of motion seems to be.

This is more easily appreciated if we are looking from a rapidly moving train. By holding in view several objects which are at varying distances, such as a fence by the roadside, a bunch of shrubbery a hundred yards away and an elm tree half a mile off, the motion from us will seem to be in inverse ratio to the distance; the fence rails will seem to be rushing by with such speed that the individual details will be indistinguishable and the

impression will be confused and unstable. The fence itself will seem to be in rapid motion and flying past us. The shrubbery will also appear to be moving by us but more slowly. The tree in the distance will seem to be still, till we look beyond it to the distance mountain top, and then it will appear to be slowly moving past us.

Illusory Sense of Motion

The sense of motion is emphasized by the relationship of one object to another that appears to be moving faster because of our nearness to it. An illusion is often produced of an object that seems to be in motion when it is we ourselves that are moving and the object is still. or the reverse in which we appear to be still when it is we that are moving and the object itself is quiet. This is most evident in the starting of a railway train on the track next to the one in which we are waiting, or from a ship's deck as we are leaving the pier. We may feel quite convinced that it is our train that is in motion although it has not yet started, or that it is the pier that is moving instead of the boat. A far distance object such as the moon or a star may be speeding across the heavens with almost inconceivable rapidity and yet seem absolutely stationary until we watch it for a few minutes in relation to a flying cloud or another star.

All of this may seem to be a long introduction to a very simple subject, but it is necessary to understand how the eyes act together and in relation to moving objects if we would realize how moving objects may disagreeably or even disastrously affect them. It is even necessary to know a little more about the eye and its construction as well as of its reactions to outside influences.

The eye warns us of the approach of a coming automobile. It prevents us from colliding with passersby in the street. It has the quality of recognizing brightness and moving forms to a higher degree than can the visual center. This may be easily demonstrated by looking directly at a star of lower magnitude. If the eyes be then directed a little to one side or the other of it, its brilliancy will be immediately increased. This area is made up of a preponderance of longer and slimmer nerve terminals which are called rods. Many birds have almost exclusive rod terminals which enable them to avoid each other in their rapid flights. A person standing in the twilight will hardly be seen until he moves; then at once this part of the eye is conscious of his presence.

Elements of a Motion Picture

The importance of these physiological facts will be apparent when we realize that in looking at the screen we are watching the blending of a series of enlarged pictures illuminated by transmitted light projected from a distance.

There are, therefore, four elements to be considered in an inquiry as to whether the pictures shown in this way can in any degree be injurious to the eyes of the observer. These have to do with the quality of the film, with the arrangement of the lighting and the mechanism of the motion, and with the position of the observer. The final and important requirement is that his own eyes shall function normally.

The first requisite is that the screen picture shall be clear and distinct. The captions and other descriptive matter accompanying the view should be sufficiently large to be easily read and not so redundant that the reading may not be easily completed before it disappears. That the film may be clearly shown depends on several elements. The first is the illumination. This should be adequate but not glaring. A glare is an excess of unfocused light; a sharp unshielded bundle of light rays coming from one side or the other or reflected from the screen itself, or from an unshaded light bulb in the dimness of the playhouse, will cause unnecessary discomfort.

The arrangement of the scene itself so that glaring reflections are thrown back on the audience is now of infrequent occurrence, as the good producers are employing the assistance of the best artistic and illuminating engineering talent. It is better that the hall in which the picture is shown be not too dark. Strong contrasts of light and darkness are not pleasant and the details of the picture are brought out with even greater clearness in a twilight atmosphere if there are no distracting light sources visible.

It is imperative that the film be run through with just the right degree of rapidity to make the images stand out and to move with the deliberation of actual living people[1]. The beauty as well as the eye comfort of what might otherwise be an exquisite picture is often ruined by the rapidity with which it is shown. In the exhibition of an instructive picture recently shown in an educational institution of high standing a current of twenty-five instead of sixty cycles was used. This together with some fault in the motor mechanism caused a constant flickering of the light that gave the impression of a picture seen through falling water. The sensation produced was most uncomfortable and soon became fatiguing. The whole effect of the picture was thereby lost and the illusion completely destroyed.

Worn Film Harmful

It is also important that films be retired from service after a reasonable amount of use. When they become spotted and cracked either from the heat of the lamp or from too long continued use, they give blurred and indistinct impressions and are neither attractive nor com-

(*Please Turn to Page* 30)

[1] Acceptable reproduction of sound pictures requires a minimum running speed of the film which removes this factor as an important consideration.—ED.

Important Decision on Grid-Bias Patent

THE United States Circuit Court of Appeals for the Second Circuit, in New York, on July 18, 1932, handed down a decision modifying the decree of United States District Court for the western district of New York in the case of Western Electric Company and others against Sol Wallerstein, Buffalo theatre owner.

This action was originally brought against Wallerstein for the use in his theatre of Pacent talking picture reproducing equipment which was alleged to infringe several Western Electric patents. The District Court decided that the Pacent equipment did infringe three of these patents, but that a fourth was not infringed. A fifth, the so-called Lewenstein grid bias patent, it said, was invalid. Both Western Electric and Wallerstein filed appeals. The decision just announced declares the Lowenstein patent valid and infringed but that the Pacent equipment is free of infringement on the other four patents.

Of the Lowenstein patent the decision says: "This contribution to the art has been of great merit." The invention covered by this patent is an extremely valuable factor in the design of the amplifiers used in the Western Electric sound system and is generally regarded as essential to any high grade amplifying equipment.

Wallerstein's interests were represented by Warner Brothers who set up an additional claim that because, as producers of pictures, they had a license to employ the Western Electric Recording System, they had the right also to pass a license along to the exhibitor to show their pictures on any type of equipment. The Court of Appeals denied this contention as also did the lower court. The decision in this case will have an important effect in other suits involving the Lowenstein patent now pending.

D-3 A

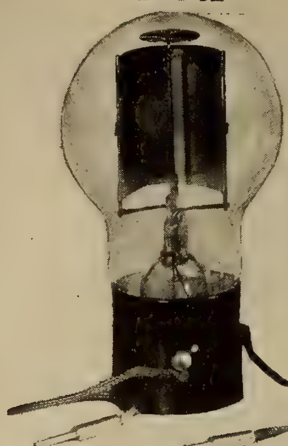
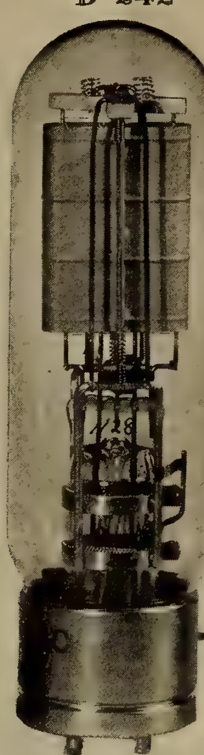


Photo-Electric Cell

A caesium argon gas-filled cell. Supersensitive and requires low amplification, hence giving improved quality with minimum distortion.

Anode Supply Voltage — 90 volts
Anode Current-40 micro-amperes (max.)
Average Sensitivity (static)-
40 micro-amperes per lumen
Peak Response — 7,600 A.
Load Resistance — ½-5 megohms

D-242



DUOVAC Sound Projection Tubes

Audio Power Amplifier

A new 50-watt Amplifier. Will stand up under an overload of 100% above its rated voltage. Filament guaranteed for 1,000 hours under normal conditions

Filament — 10 volts, 3.25 amps.
Plate Voltage — 750-1,000 volts.
Grid Voltage — 30, — 50 volts
D. C. on Fil.
Plate Current — 60 M.A., 56 M.A.
Amplification Factor — 12
Mutual Conductance — 3,500
micromhos.

D-264 A

Audio Amplifier

A greatly improved, practically non-microphonic tube which reduces background noise level to a minimum

Filament — 1.1 volts, 0.3 amp.
Plate Voltage — 90 volts
Grid Voltage — 4.5 volts
Plate Current — 3.5 M. A.
Amplification Factor — 8
Mutual Conductance —
770 micromhos

D-205 D

Filament — 4.0-5.0 Volts.
1.60 Amps.
Plate Voltage-300 Volts
Grid Voltage — 22 Volts
D. C. on Fil.
Plate Current-22 M. A.
Amplification Factor-7
Mutual Conductance —
1800 micromhos
Max. Plate Dissipation —
10 Watts.

Audio Amplifier

A Special purpose amplifier tube designed to handle the output of the 46 & 41 amplifier without distortion

THE STEP-BY-STEP SERVICING OF SOUND EQUIPMENT*

J. Mauran

PHOTOPHONE DIVISION, RCA-VICTOR COMPANY

Every forward-looking projectionist is vitally interested in the operation of servicing sound picture reproducing equipment. Of what the service operation consists, the procedure followed, the tools used and how to check back on results obtained is set forth in detail in the accompanying article which covers the entire servicing operation.

IN dicussing the problem of maintaining sound installations, it is convenient to divide the equipment into three main subdivisions: (1) the sound head, (2) the amplifier and control panels, and (3) the speaker. Of the three groups, the sound head requires the most attention, and is the most exacting in its adjustments. The condition and adjustment of every mechanical unit used in the constant motion of the field in front of the light beam affects the quality of the sound, and every part of the optical system that may affect the size, position, and intensity of the light beam influences the volume and the quality of the reproduction.

Of the various components, the condition of the constant-speed sprocket and the adjustment of the sound gate assembly are the most critical. Unless the film moves at an absolutely uniform speed through the gate, the resultant sound will have what is termed a sprocket or gate "flutter," the exact designation depending upon the cause of the flutter. The presence of such a flutter is usually evidenced by a characteristic rasping noise, which is particularly noticeable at the higher frequencies.

Where this condition exists, the trouble may be due to excessively worn sprocket teeth, the use of a constant-speed sprocket of incorrect diameter, or to the lack of the necessary tension in the springs of the pressure gate.

The adjustment of these springs is quite critical. If the tension of the spring is inadequate, there will not be a sufficient "drag" or "holdback" on the film, with consequent gate flutter. On the other hand, if the tension is excessive, there will be abnormal wearing of the teeth of the constant-speed sprocket, with a decided tendency to "hook."

Light Beam Adjustment

The adjustment of the light beam passing from the exciter lamp to the sound track has a material bearing on the quality of reproducion. Fig. 1 represents diagramatically the various positions of the light beam with reference to the sound track. Fig. 1(*A*) shows the position of the light beam when properly adjusted in reference to the sound track. Fig. 1(*B*) illustrates the case where the light beam has the proper lateral adjustment but has not been properly focused. In the case of Fig. 1(*C*) the light beam does not have the proper lateral adjustment, so that it does not scan the entire width of the sound track. In Fig. 1(*D*) the light beam is properly focused and has the proper lateral adjustment, but the light slit is not horizontal.

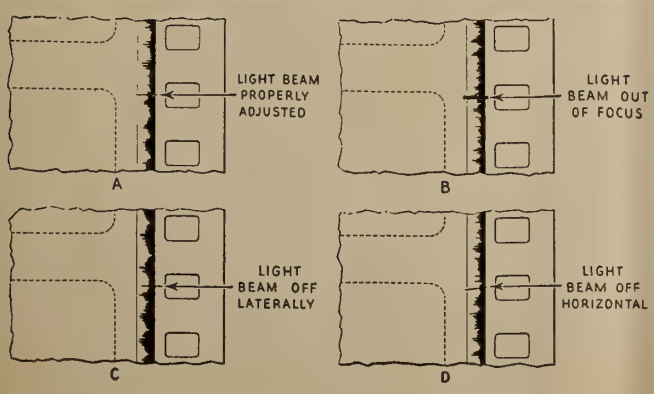
In all the last three cases, distortion in one form or another will be introduced, with a consequent loss in the quality of reproduction. To maintain the normal high standard of reproduction, it is essential that the service engineer carefully check the adjustment of the light beam on his periodic visits to the theatre, and to make the necessary readjustments in accordance with the methods to be described.

Other maintenance items on the sound head are exciter lamps and photoelectric cells. Exciter lamps, in particular, deteriorate with use, and have to be replaced frequently. As their replacement and adjustment in the socket is a comparatively simple process, however, they are rarely the cause of annoyance. In addition, there is the possibility of obtaining poor sound quality or of sound outage due to excessive wearing of gears and drive chains and loosening of belts.

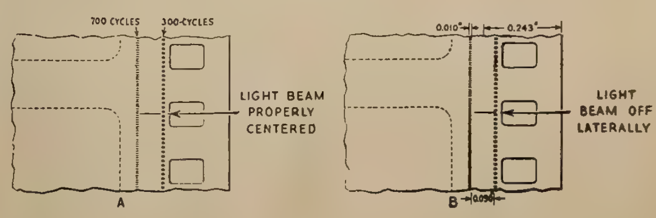
Compared with the sound head, amplifiers present an easy problem to the maintenance man. Tubes, and rectifier stacks or batteries, where used, are the only items that deteriorate materially with use, and should be inspected periodically to avoid possible sound outage or deterioration in quality.

Recent improvements in rectifier stacks have rendered these units quite

* Presented at the Spring Meeting of the S. M. P. E., Washngton, D. C., May, 1932.



Left: Fig. 1. Diagrammatic representation of the various positions of the light beam with reference to the sound track
Right: Fig. 2. Enlarged facsimile of the "buzz" track



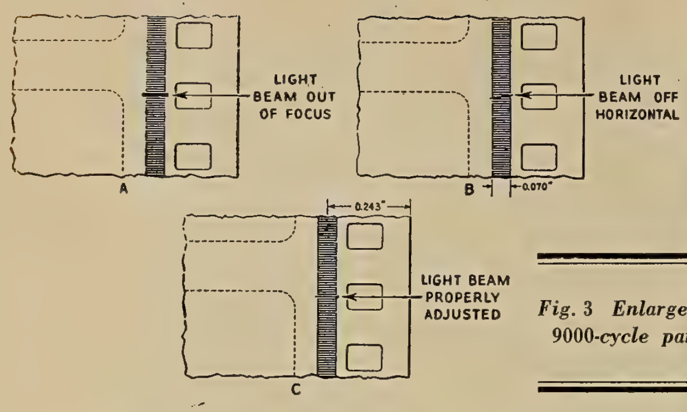


Fig. 3 Enlarged diagrams of the 9000-cycle parallel line track

reliable and have prolonged their life, so that no trouble should be expected from then until the equipment has been in service for several years. As they approach the end of their useful life, however, there is a gradual increase in the reverse current and in the internal resistance, with a consequent loss in efficiency of rectification. At this stage, the stack should either be replaced or kept under close survelliance to avoid sound outage.

Power Supply

Batteries have always been considered a reliable source of direct current. It is rather difficult to give an accurate estimate of the life of a storage battery since the life is so materially affected by the number of hours it is used daily, the rates of charge and discharge, and the general care given by the projectionist. Regardless of this fact, however, a battery should not be a source of anxiety in view of the fact that it invariably gives adequate advance indication of approaching failure. These danger signals consist of its inability to hold a charge and the necessity of frequent charging to maintain the proper voltage.

Various component parts of the amplifier are, of course, subject to failure. Such failures are, however, infrequent, and cannot be predicted to forestall a possible sound outage. The maintenance man's only recourse is to see that the various amplifier units are kept reasonably free from dirt and dust, particularly in the section between exposed wires or terminals, and periodically to ascertain that none of the power transformers or condensers are heating excessively.

We now come to the question of speaker maintenance, which presents an even simpler problem than the amplifier. Assuming that the stage speaker has been properly installed behind the sound screen, there is very little likelihood of difficulty from this source unless someone tampers with the unit. The service engineer, however, generally makes it a point to listen carefully to the reproduction from the stage speaker to cover rattles or distortion that may have developed since his last visit to the theatre. Where such trouble is definitely traced to the loud speaker, it is usually found to be due to a loose wire or a lateral displacement of the speaker cone, allowing the voice coils to rub against the side of the field air gap.

The sound screen, behind which the speaker is located, frequently presents a maintenance problem, particularly if it is of the porous variety. The pores of such a screen accumulate dust, and, unless the screen be cleaned periodically, there will be gradually loss in sound and deterioration in quality. Where such difficulty is experienced, the question as to whether the screen is at fault can be definitely decided by comparing the volume and the quality of the speaker output with the screen in place, and with the screen "flown" or removed.

The foregoing outline briefly covers some of the main problems encountered in the maintenance of theatre sound equipment. It indicates the parts of the equipment that must be kept under surveillance or checked periodically to prevent sound outage and to obtain the best possible sound quality and service from the equipment.

On their periodic visits to the theatre to make such inspections, the service engineers encounter some difficulty due to limitations of working time and of space in which they must perform their tests. As there can be no interruption of the performance, practically all the checking operations have to be performed either before or after it. This, of course, means additional expense for the exhibitor. Therefore, to keep overtime to a minimum, the work must be performed as rapidly as possible, and, because of the limited space in the average projection room, it must be done with as few instruments as possible. These two factors, as well as the obvious one of reasonable accuracy, must naturally be taken into account in designing test equipment to be used in maintaining sound equipment.

Service Tools Required

The RCA Photophone service engineer's test equipment consists essentially of a tool kit, a multitester or set analyzer, and a test reel. There is very little of special interest in the service engineer's tool kit. In addition to items such as hammers, screw drivers, files, wrenches, pliers, etc., the kit is furnished with a relay adjusting tool, a relay contact cleaner, special size socket wrenches, a taper-pin pusher, a gear remover, a circuit tester, and a special optical adjusting tool. The use of the last item will be described in connection with the use of the test film.

The KR-13 multitester specially designed for RCA Photophone, embodies in a compact form all the meters and special testing devices needed in sound equipment work. The various meters, with the necessary shunts and multipliers, will measure direct currents from 1 microampere to 75 amperes, d-c. voltages from 0.1 to 750 and a-c. voltages from 1 to 250.

By means of a plug that may be inserted in the various amplifier sockets, tube and amplifier measurements may be made under conditions simulating those of normal operation. A microammeter, with a range of 15 microamperes, is used for checking photoelectric cells and for making measurements of high resistance.

In addition to the above, the KR-13 multitester is provided with special binding posts for making "continuity" tests and for phasing speakers. A thermal output meter, in conjunction with the RCA Photophone test film, is used for making frequency response measurements and optical system adjustments.

Standard Test Film

The standard RCA Photophone test film is used as a source of signal output for making practically all the necessary measurements and adjustments of sound equipment. The film is approximately 1,000 feet long and has a sound track on each edge. It is so recorded that it is unnecessary to rewind the film to play the track on the opposite edge of the film. The recording on one edge of the film includes 140 feet of "buzz" track, 200 feet of 9,000-cycle parallel line track, 100 feet of 1,000 cycles followed by a constant voltage frequency test track varying, in equal steps, from 50 cycles to 6,000 cycles.

Fig. 2 represents an enlarged facsimile of the so-called "buzz" track. Es-

Fire Prevention Tips

The projectionist himself is the most vital link in the chain of fire prevention in the theatre. Given the most up-to-date protective equipment, a theatre still is almost wholly reliant upon the projectionist for an adequate measure of security.

sentially, it consists of two chopper tracks, each 10 mils wide, spaced 90 mils apart. The chopper track nearest the sprocket hole is a 300-cycle record, and the chopper track is a 700-cycle record.

The track is designed to make the lateral optical system adjustment and to determine the extent of film "weave" in the sound gate by a listening test, without the aid of eyepieces or reflecting mirrors. When the film is properly adjusted in the sound gate, the light beam from the exciter lamp will fall between the two chopper tracks, and there will be no signal output from the stage speakers. When, on the other hand, the light beam is off to one side or the other, as illustrated in Fig. 4(*B*), a constant note will be reproduced in the speakers, the frequency and volume of which will depend on the extent and the direction in which the film is off.

If the note heard is of 300-cycle frequency, the film guides should be adjusted to move the film outward; if the 700-cycle note is heard, the film guides must be adjusted to move the film further in.

Occasionally, due to a warped film or a maladjustment of the gate tension springs, difficulty will be experienced through film "weave." Such a condition will be indicated by the reproduction in the speakers of a 300- and a 700-cycle note alternately, the extent and frequency of the weave corresponding to the volume of the signal and the frequency of the alterations, respectively.

Having centered the light beam on the sound track by means of the "buzz" track, as described above, the 9,000-cycle parallel line track is used for making the rotational and focal adjustments of the optical system. This track consists of a series of parellel lines, each 70 mils long and 1 mil wide, spaced 1 mil apart.

Fig. 3 shows enlarged diagrams of the 9,000-cycle parallel line track: (*A*) shows the case where the light beam has not been properly focused on the sound track; (*B*) shows the case where the rotational adjustment is incorrect; that is, the light beam is not horizontal; (*C*) shows the case where both the focal and the rotational adjustments have been properly made to obtain maximum response. It is obvious from these diagrams, and the theory of reproduction from film, that the maximum signal will be obtained from the sound track when the light beam is sharply focused to a width of 1 mil. or less, and is absolutely parallel to the lines on the sound track.

In making the adjustment, the thermal output meter on the multitester is connected across the speaker terminals of the power amplifier, with a resistor load substituted for the speaker voice coil. With the 9,000-cycle parallel line track running through the sound gate, the focal adjustment of the optical system is gradually varied, and the reading of the output meter is observed. As the light beam becomes more and more concentrated, the output of the amplifier is gradually increased until focus is attained. If the adjusting screw is turned beyond this point, the readings of the output meter will pass through a maximum and start to decrease. The adjusting screw should then be turned back until the peak is reached, at which point the set screw must be tightened.

In the latter type of optical systems, the light slit is fixed with reference to the machined base of the optical unit, so that no adjustment is necessary. On

(*Please Turn to Page* 25)

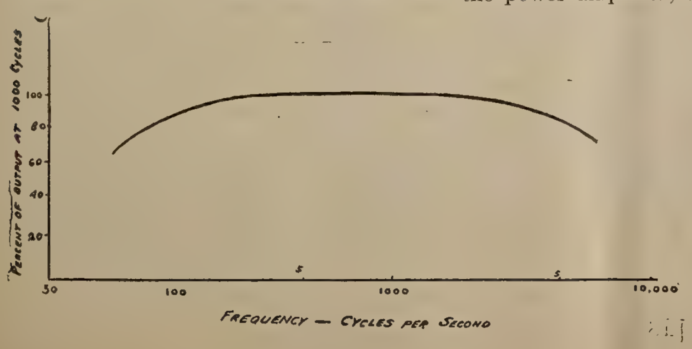


Fig. 4. Characteristic output curve corrected for slit losses

REPAIR WORK BY PROJECTIONISTS

James J. Finn

THERE has been widespread discussion within the craft relative to the limits of the projectionist's responsibility in keeping the projector mechanism in good running order through the medium of effecting repairs. Opinion varies all the way from that of the extremely narrow view of that group which holds that the projectionist should do nothing but attend the projector to that of the very liberal group which sustains the opinion that provision be made in the projection room for the inclusion of a machine shop in which certain major and all minor repairs could be made.

One can adopt a sensible attitude in the matter, without prejudice to either school of opinion. All fair-minded projectionists will concede the justice of the viewpoint that any work done by the projectionist to keep the show going falls within the limits of his responsibilities.

This statement is made with full cognizance of the fact that in certain sections of the country the projectionist receives "instructions" stating that he is only to "operate" and not make even a single minor repair.

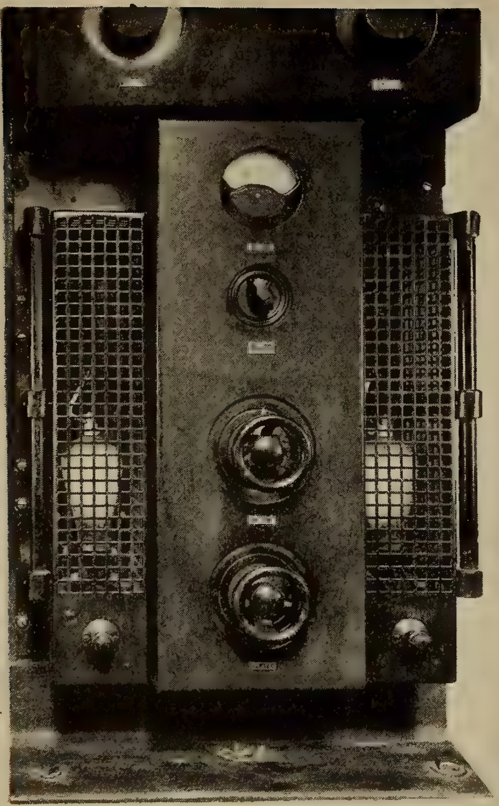
A Shortsighted Policy

Reams of copy designed to expose the shortsightedness of such instructions could be written, but so palpably unfair are such instructions—to the theatre owner, to the organization and to the projectionist—that they do not warrant extensive discussion at this time.

If a projectionist desires general recognition of the importance of his position in the theatre, and this writer holds that such recognition has been too long delayed, it is to be expected that he must assume certain responsibilities which are the inevitable accompaniment of such recognition.

The projector is the heart of the projection room, and it is this mechanism the anatomy of which should be thoroughly understood by every projectionist. Careful consideration of the problem of projection room upkeep leads one to the conclusion that a first-class projectionist should be able to make the following repairs:

1. Replace both upper and lower sprockets and sprocket pad rollers.
2. Put on film trap door lever spring.
3. Replace all parts on the film trap assembly, which includes the intermittent film guide assembly.
4. Replace the automatic fire shutter lift assembly.
5. Replace governor weight links on the film gate trap assembly. On the new Simplex projector with rear shutter a little difficulty may be experienced in effecting this change, but it can be done by the projectionist.
6. Replace the upper and lower magazine fire rollers.
7. Replace film stripper (S-508-D).
8. Change intermediate gear and shaft (G-1, including G-12, which is the formica intermediate gear and plate assembly).
9. Replace main driving gear (G-112-G).
10. Remove and set shutter.
11. Remove and replace the intermittent movement.
12. Keep scruplously clean the entire mechanism and in particular keep the fire rollers rolling. The latter will help to prevent fire and will sharply reduce scratch marks.



Showing the appearance of panel after conversion for use of the new 258-A mercury vapor tube is accomplished

TUBE CONVERSION PROCESS FOR W. E. SYSTEM

Modified rectifier permits use of newly developed 258-A mercury vapor tube in place of 219-D's.

PROJECTIONISTS will be interested in the very latest development for Western Electric sound reproducing systems which utilize the 6,000-A Rectifier. This new development is a modification of the rectifier which permits the use of the newly developed 258-A mercury vapor vacuum tubes in place of the 219-D tube originally used. This equipment is available through Electrical Research Products, Inc.

The modification parts, which are shown in the accompanying illustration, consist essentially of two apparatus units which can be mounted on the front of the 520-A Rectifier Panel over the space now occupied by the vacuum tube sockets. Each of these apparatus units houses a cut-off switch, socket to accommodate the new tube, a terminal strip and a plate circuit resistor.

In addition to the installation of these apparatus units, certain wiring changes are necessary in the panel itself.

The apparatus units are completely enclosed within a substantial cage, which serves the double purpose of making it impossible for the operating personnel to come in contact with the high voltage connections and protecting the vacuum tube from being damaged. A cut-off safety switch is provided on each apparatus unit to automatically break the high voltage plate circuit of the tube whenever the cover is removed for tube replacement or for any other purpose.

A brief analysis of the relative costs of these two tubes and a comparison of life test data taken directly from theatre systems clearly show the economic advantages to be gained by making such a change. The cost of the 258-A tube is only approximately 20 per cent that of the 219-D tube, and in addition it is averaging under actual operating conditions at least 2½ times the average life of the 219-D tube.

Considering these two facts, it can be seen that the substitution of tubes made possible by the conversion results in a reduction of over 90 per cent in the cost of tube replacement.

Another advantage of this change is that there is less power consumed by the 258-A tubes which results in a slight additional operating saving. The fact that the modified panel operates at a lower temperature will be a welcome feature in many projection rooms.

A number of circuit theatres have already adopted this conversion equipment, and ERPI reports that many exhibitors have expressed a preference for it. A sharp reduction in maintenance costs of theatre sound reproducing systems, with quality held to present high standard, makes this a very desirable addition to modern sound systems.

STEREOSCOPIC METHOD UTILIZES NEW TYPE BEADED SCREEN

DEVELOPMENT of a new method for the stereoscopic projection of motion pictures, which, it is said, makes possible a perspective of three dimensions without the necessity for any special viewing devices, has been announced by its inventor, Douglas F. Winnek, of New York.

While more than 200 patents have been filed in the United States Patent Office in the past thirty years, all aiming to produce three-dimensional vision on the screen, only three fulfill the requirements, Mr. Winnek said. These three, however, necessitate the use of special viewing devices held in front of the spectator's eyes.

Mr. Winnek said his method consisted of a new type of motion pictures viewing-screen with a beaded cellophane surface, each bead acting as a lens. There are 576 beads to the square inch. The pictures to be projected are taken with a binocular camera, equipped with two lenses, one taking the view seen by the right eye and the other that seen by the left. The right and left eye pictures are then combined on the beaded screen through a binocular projector. The result, Mr. Winnek said, is a three-dimensional view.

To obtain three-dimensional vision, Mr. Winnek explained, the right eye and the left eye of the observer must see only the individual views as seen respectively by each eye alone. It is the combined vision of both eyes that enables us to see depth because each eye observes an object from a different aspect.

The binocular camera, of which there are several types now on the market, takes alternate films of the right-eye and left-eye views, which the binocular projector combines, or superimposes, on the beaded, cellophane-coated screen.

BARROWS ON EUROPEAN TRIP

Thad C. Barrows, President of Projection Advisory Council, sailed for Europe on August 28 for a four weeks' tour which will take him into England, France, Germany, Switzerland, Italy and Spain. While abroad Barrows, who also is President of Boston Local Union 182, will confer with regional vice-presidents of the Council—Stanley T. Perry in London, and E. Bechet in Paris.

AN EXHIBITOR ESTIMATE OF PROJECTION PROBLEMS

Stanley Sumner

MANAGING DIRECTOR, UNIVERSITY THEATRE, CAMBRIDGE, MASS.

***Projectionists have long inclined toward the view that the exhibitor or manager lacked sufficient detailed knowledge of projection work to maintain a really close contact between projection room and theatre office. In fact, projectionists generally assume that it is futile to expect any aid from the theatre office in the matter of effecting improvements in the technique of the art. This suppositious bubble is neatly pricked by the accompanying article which, while probably not indicative of theatre owners and managers as a group, reflects the increasing interest of the "office" in all phases of projection work. Mr. Sumner's article was included in the symposium on "The Film Problems of Theatre Operation", an outstanding feature of the last S. M. P. E. meeting. At last the exhibitor, much abused in these columns of late, has his say on projection.*—Editor.**

IN connection with the operation of theatres, I feel that there are some problems which, though in themselves trivial, might be studied intensively, particularly as regards the technical instruction of those in charge of the handling of film. I am referring particularly to the care of the film when it is in the theatres of the country, actually earning the money that keeps the wheels of Hollywood in motion.

The industry made great strides in improving film stock, photographic processes, sound reproduction, in fact, everything that contributes to the motion picture; but the seemingly trivial things must not be neglected. These things should be called to the attention of those who handle film and, among others, the following topics should be considered: film in use; reels on which the film is wound; cases in which the reels are shipped to the theatres; inspection departments maintained by the film exchanges, and replacement requisitions as received in the home office originating from the film exchanges out in the various territories.

Reels and Cases

The winding of film on a bent reel will, even in a single winding, spoil the perfect sound and photographic effects, obtained only after long years of endeavor.

The packing of new and perfect reels into a film case that has been dented and jammed will, in one shipment, spoil the reel and in turn the film. A film case is rarely opened without disclosing a collection of dirt, dust, sweepings, and film clippings. The accumulation of a year or more rests on the bottom of the case. In shipping, these cases are inverted many times, the dirt is scattered over the reels and gradually works into the windings, causing the scratches with which you are only too well acquainted.

The young women employed in the film exchange inspection rooms pass film as satisfactory when most of the sprockets on one side of the film remain intact; a patch is approved if it is cemented at least halfway across; the alignment of the rewinder seems to be of no importance; and whether the band will fit over the film after it is wound, whether it is tightly or loosely wound or unevenly wound, is given little or no consideration.

I recommend that every exchange center employ an efficient and competent film expert (as is done by the Boston offices of Metro-Goldwyn-Mayer and Paramount), who should have complete jurisdiction over the inspection, receiving, and shipping departments. His duties should be: (1) to delegate competent persons to inspect every film case; (2) to see that the film case is free from dirt and that it is not bent; (3) that the required number of reels will fit into the film case easily and without jamming; (4) to ascertain whether the reels are in perfect condition; (5) to make sure that the film is wound on the reels so that the sides of the winding will be smooth from the hub to the periphery; (6) to inspect personally and at frequent intervals the film approved by the various inspectors, *etc.*; (7) to require inspectors to report film damage of any kind immediately after the film is returned by theaters; (8) *and to require that theaters pay for such damage.* If this inspection is done honestly and efficiently and the film is sent in perfect condition to the theater, a confidence would be built up in the minds of theater managers and they would be satisfied to pay for damaged film.

It is not unusual for my projectionists to work two or three hours on a single feature in order to put it into the condition they think it should be to assure its safe travel through the projectors; and I want at this time to give you a brief account of an occurrence that I feel will convince you of the need of properly and adequately instructing film exchanges, theater managers, and projectionists in matters like these.

A Case in Point

About three or four months ago my chief projectionist reported that he had been working more than two hours on a Fox feature and had made so many cuts that he felt that he had ruined the continuity of the picture, cutting in some instances, where the sprockets were completely broken out, as much as twenty feet. He had gone hurriedly through the last four reels without attempting to make repairs, and was sure that if it were to be put in usable condition, there would be nothing left of the story.

I got in touch with the local Fox exchange and found that although no extra print was available, there was one ready for shipment to another local theater that could be exchanged for this one if we could arrange to return the print immediately.

The exchange was made; and upon inquiry, prompted by curiosity, I found that the bad print was being sent to a theater seating about 2,000 persons in a city adjoining Cambridge. The exchange manager told me that he never received complaints about the condition of his film. I told him that I was not surprised, and wagered that he would receive no complaint from the theater that was to receive the print that I had reported as fit for the junk heap. We found that this theater ran a full twelve shows and made no complaint either during or at the end of the run.

I might say in passing that in this particular theater, two reels of a fea-

ONE-DAY S. M. P. E. FALL MEETING IN N. Y.

THE Fall meeting of the Society of Motion Picture Engineers will be held at New York, N. Y., on October 5, 1932. Owing to prevailing conditions, the Fall meeting this year will be limited to one day and will be coincident with a meeting of the New York Section. The tentative arrangements provide for holding the meeting in the auditorium of the Electrical Institute of New York, in the Grand Central Palace, Madison Avenue and 48th Street, New York, N. Y.

An attractive technical program is being planned by the Board of Managers of the New York Section, and it is expected that preceding the meeting an informal dinner will be held at a hotel convenient to the place of meeting. The election and installation of the new officers for the year 1933, of both the general Society and of the New York Section will take place at the meeting. Nominations have been completed and voting ballots are being mailed to the active membrship of the general Society and the New York Section respectively.

Complete details concerning the meeting will be mailed to the membership of the Society in the near future.

ture had been burned up the week before this particular incident occurred.

I recommend that one print of each subject, both shorts and features, be maintained solely as replacement prints so that never, except in the case of emergency, shall a print be sent from an exchange in imperfect condition, normal wear and tear excused. I further recommend that the home offices have on hand a sufficient number of prints to maintain upon requisition the quota of replacement prints in the exchanges.

Cooperation by Unions

I recommend that a system of educating the projectionist be evolved and that every projectionist union be encouraged to detail a man to inspect the conditions of projection rooms within a given territory; and that the union be encouraged to take drastic action, if necessary, against men whose work does not measure up to the given standard.

I recommend that a standard code of inspection be worked out and that it be used by all distributors; such a code has been suggested to me by Mr. J. L. Caddigan of the Boston Paramount Exchange. In closing, I shall read a brief paper that Mr. Caddigan sent some time ago through the territory served by his exchange:

"Dependence is a poor trade to follow, and projectionists who rely solely upon the film exchange to furnish them good prints may find their confidence misplaced. Projectionists are neglecting a great responsibility. Every poor print received in the projection room should be reported immediately to the theater manager who, in turn, should forward the report to the film exchange in question.

Report Bad Prints

"The film exchange inspection department is in a sense like a dam, holding back from the theaters a flood of bad prints. As the inspection department is a combination of mechanical and human elements, its perfection can not be guaranteed, and occasionally a weak spot develops in its structure.

"Hydroelectric power companies throughout the world keep a constant watch on their source of power (the dam), and an immediate report is made of any sign of weakness. A poor print is a warning of weakness in the structure of the inspection department of the exchange; and unless the exchange receives immediate notice of this condition, a serious leak might develop, flooding the theaters with poor prints and bringing disaster to the box-office and projectionists.

Projectionist's Attitude

"An idea prevalent among projectionists and managers is that reporting of poor prints is void of results. This is an error. If the report is addressed to the proper person in the exchange, the sender may be sure that it will receive immediate attention. A leak is of no value to anyone, and the projectionist should never hesitate to report a poor print, as he may find his neglect to do so will be a boomerang.

"Bad reels and damaged film cases—in fact, any agency that tends to cause film mutilation and damage, should be noted in these reports.

"The film exchange is desirous of serving the theaters with good prints. Theaters and audiences are entitled to them; and with cooperation between the exchanges and the theaters, poor prints will become a memory."

[NOTE: Mr. Sumner will contribute to an early issue another interesting article on projection problems as viewed by the exhibitor.—*Editor.*]

Projection Prime Theatre Problem, Says M. P. T. O. A. President

M. A. Lightman

PRESIDENT, MOTION PICTURE THEATRE OWNERS OF AMERICA

[NOTE: This paper was presented immediately following Mr. Sumner's and also formed a part of the symposium on "The Film Problems of Theatre Operation."—*Editor.*]

As for the exhibitor, there are three things of prime importance to him: (1) the projection of the picture to the screen; (2) the comfort, happiness, and freedom from eye-strain of his patrons; and (3) the entertainment value of the picture itself.

Suggested Improvements

The projection of the picture is what interests the engineer. Although the motion picture is today far superior to what it was in the beginning, yet one who thinks of it in terms of mechanical perfection can easily become annoyed. There is much room for improvement, especially as regards the reproduction of sound. Some means must be taken to prevent the emission of noise from the projection room into the auditorium, and, in fact, to make the projection room quieter, so that the projectionist will be better able to determine the quality of the reproduction. The projectionist would be more attentive to his duties in a quiet room; noise tends to make him careless.

The elimination of noise would do wonders in enhancing our appreciation of silent sequences. The important feature of a picture is the contact that is established between the audience and the actors, and with disturbing noises it is impossible to enjoy a complete appreciation of the picture.

The placing of an image on the screen is the last phase of the business, yet, in

(*Please Turn to Page* 27)

Fire Prevention Tips

A theatre has that degree of protection against fire that is reflected in the alertness and carefulness of the projectionist. He is the one definite safety factor within the theatre—the one man upon whom everyone else in the theatre must rely for protection against fire.

Fire Prevention Tips

It is true that few fires spread beyond the projection room. But the projection room, and not the stage, happens to be the station of the projectionist, and any trouble that results from a film fire will be handed out in large doses to that man who is handy—to you, Mr. Projectionist.

The Ip EDITORIAL PAGE

Vol. 3, No. 2 AUGUST 1932

The Academy Considers Film Mutilation

The Academy of Motion Picture Arts and Sciences, mindful of its success in introducing the Standard Release print and, lately, the Uniform Aperture, is sponsor for a Research Council which will concern itself with an investigation into the causes of film mutilation. It is to be earnestly desired that the Academy not repeat its mistake of last year and ignore the recommendations of practical projection men who probably know more about the problem of film mutilation than any ten research councils that could be recruited without the projection field.

Another recommendation in the form of a reprint from our November issue is offered for consideration by the Academy:

> As for the specific matter of film mutilation, the answer lies not in committee reports, trade paper comment, fire insurance statistics or/and complaints from the technical field workers. Assuming the existence of an active interest on the part of the industry's executives, the matter should be put squarely up to a board to be composed of representatives of, say, the following: (1) producers (2) exhibitors (3) exchange operations supervisors (4) projector manufacturers (5) projection supervisors (6) technical societies (7) fire underwriters, and (8) film manufacturers. There may be one or more omissions to the foregoing list.
>
> With such a board applying itself diligently to the problem, the answer should be forthcoming quickly. And once established, the board's recommendations should be *enforced*. Such a board would put a stop to all this silly "buck passing" and would place the responsibility squarely where it belongs.

Of investigation into the causes of, and of comment upon film mutilation we have suffered no lack. A little action, just a little, would stand in refreshing contrast to the reams and reams of words which have been dispensed on this subject. Immediate action by a board composed of members from every branch of the industry is urgently needed, as film mutilation is increasing steadily. We have long urged that a penalty be imposed on those theatres that persist in mutilating film, but this is too much to be hoped for at this time.

We Mention the Unmentionable

Grafting projection men whose judgment is affected by the amount of "royalty" they collect for placing their okay on a given equipment constitute one of the gravest dangers to the well-being of the projectionist craft as a whole. We do not recall ever having seen this subject discussed elsewhere in the motion picture trade press, but that the evil is rampant in the projection field is not to be doubted. Foolhardy it is to indulge in generalities, and utterly lacking in "punch" is that story which merely implies the existence of wrongdoing. Yet, these few words will be justified by the statement that there is nothing which so cheapens the projectionist and lowers his standing within the industry as does the purchase of equipment not on merit but on the basis of graft-taking. Another consideration is the fact that once an equipment is accepted for service and the "consideration" paid over, the responsibility for its continuing operation rests solely with the innocent, hard-working man in the projection room.

We offer no apology for writing these words. In hewing close to the line of what we see as the right we are content to let the chips fall where they may.

A Few Bits of Bric-a-Brac

All-A.C. operated sound picture reproducing equipments, a dream of two years ago, today are an actuality. Still, how many projectionists have ever felt the necessity for investigating the possibilities of such equipments from the angle of effecting better service and less operating expense for their employers? Not many, it can safely be said. Batteries as a source of power supply for sound picture equipments are outmoded. Also, 1-A photo electric cells are not modern; 3-A's are now available. Unpopular though it may be, the news is that a satisfactory remote volume control is available. Nothing in the line of fact has been adduced to justify the positioning of speakers behind, instead of at the sides, of screens. Rear shutters should be attached to every projector. The new B. & L. condenser combination affords fifty per cent more light with h. i. lamps. Projector parts and replacements still are for sale, the present state of disrepair of your projector to the contrary.

Wake up, Mr. Projectionist. Take a look about you and at least make an attempt to merit some of the nice things which have been said about you of late by industry leaders.

The S.M. P. E. and Projection

The S.M.P.E. at last seems to be emerging from its comatose state insofar as practical projection problems are concerned. Largely responsible for this obvious improvement is, of course, the splendid work of the Projection Practice Committee during the past year. Under the extremely able guidance of Harry Rubin this Committee made a splendid contribution to the art of projection and thereby not only improved conditions but also gained much prestige for the craft. Still, candor compels the observation that the progress of the Committee would have been less rapid were it not for the patronage of Dr. A. N. Goldsmith, President of the Society. Dr. Goldsmith it was who set a precedent by recognizing the true relation of projection to the welfare of the industry and he it was who attended session after session of the Committee and supplied the inspiration and enthusiasm which resulted in as fine a piece of work as has ever been done by projection men.

A little more support by projectionists in the field would result in even better work by this Committee.

PROJECTOR HEAD AND REWIND CAUSE MOST FILM SCRATCH MARKS

SCRATCH marks on film is probably the outstanding difficulty with which projectionists have to contend. Alert projection work and the very best of equipment kept in top-notch shape go for naught when scratched film is used. Scratching of film may be caused in various ways, but the two most important causes of scratched film are the projector head and the rewinder.

The projector head may cause scratching in any one or more of the following ways:

1. Rollers in the upper or lower magazine that are worn to such an extent that the tracks are on a level with the roller. The accumulation of dirt in the roller holder assembly will prevent the rollers from rolling and will cause wear on one side. Moving film riding down on a flat surface will cause deep emulsion scratches.

2. Worn film trap shoes will result in the emulsion side of the film being scraped by the aperture plate.

3. Too much tension on the film trap door, trap door pads and shoes. Usually a combination of all these.

4. A mutilated, warped, nicked, bent or worn aperture plate. If an aperture plate shows even the least sign of wear, the projectionist can be certain that *his* projector has been the cause of many thousands of feet of film being scratched. Scratch marks on film are cumulative.

5. A warped film trap (E-16), will also cause the aperture plate to become warped. Usually caused by excessive arc lamp heat.

6. Oversize top or bottom loops in the projector head, or oversize loop in the sound head.

7. Too much tension (in this case, pull), on the take-up.

8. Film running on sprockets, as a result of defective patches, worn sprockets, worn film guides, film guides out of alignment—or a combination of any of these.

The rewind has long been known to be a source of prolific scratching and tearing of film. Most of the comment which has appeared heretofore on this topic had to do with operation of the rewind at excessive speed. Other rewinding faults are:

1. Testing film for bad scratches by placing the whole palm on the moving film (emulsion side is always on top). The proper way to test film is with the thumb on one side of the film, and the index and middle finger on the other.

2. Rewinding the film loose and then, while holding the dummy side of the rewind, taking up the slack on the moving side.

3. While the film is being rewound, to suddenly apply the brake and let the motor continue to pull on the film. This results in even more serious trouble than does No. 2.

4. Rewinder out of line.

5. Bent reels.

Finn Appointed Photographer Eastern Representative

Appointment of James J. Finn as eastern representative of *International Photographer*, official magazine of the International Photographers of the Motion Picture Industries, Local Union 659, has been announced by the latter organization. Mr. Finn, who has already assumed this new duty, will act as general representative for *International Photographer* on both editorial and advertising matters having their origin in the East.

GUARD YOUR EYES

Don't read with the light shining into your eyes.

Don't read when recovering from serious illness—without your doctor's consent.

Don't read when lying down unless your head and shoulders are propped up and the page is held at right angles to your line of vision.

Don't use public towels and be careful about rubbing eyes with fingers. Dangerous infection may follow.

Don't hold your work or book nearer the eyes than 12 inches.

Don't fail to visit an eyesight specialist at the *slightest sign* of eye trouble.

Don't use eye-washes, ointments, salves or other remedies unless advised by an eyesight specialist.

Don't wear glasses not prescribed by an eyesight specialist.

Inquiring Reporter Feels the Public Pulse on Sound Pictures vs. Pit Musicians

DO you miss the orchestras which motion picture theatres had before the invasion of sound pictures? was the question recently posed by the inquiring reporter of the *New York Daily News* to six passersby on a busy New York street corner. In addition to providing an index to the tastes of theatre patrons the survey in miniature uncovers the fact that theatre patrons are becoming increasingly aware of the difference between good and bad sound reproduction, two commentators laying particular stress upon this angle.

The answers to the foregoing question follow:

YOUNG LADY SECRETARY: "No, although I am sorry for the many musicians who have lost their jobs. I think the music provided by most talking pictures is much more entertaining. The orchestras which make the records are better, and the mechanics are improving."

POLICEMAN: "Yes, very much. Canned music is canned music, and you cannot make it sound nearly as musical as melodies from a real orchestra. The musicians are in a terrible condition, and the talkies have dealt a blow to musical culture."

HOUSEWIFE: "I do. The old orchestras, while not very large, were usually made up by talented musicians who took pride in their work. Often their numbers were more entertaining than the feature picture. I'd like to see them back."

STORE MANAGER: "Certainly I do. I am a music lover and I can say with conviction that the old movie house orchestras provided much better music than is given by the average talking picture, even when the mechanism in the theatre is in the best of condition."

HOUSEWIFE: "Yes. Of the two systems, I think that the real musicians provided the better and more entertaining music. The discharge of the musicians has not been justified, because the expense saved has not resulted in lower admission prices."

TRAFFIC MANAGER: "I certainly do. The old movie house orchestras, made up of talented musicians, were far superior in every way to the imitation music given to us by the talking picture. In large movie theatres, the orchestra is still the feature."

Fire Prevention Tips

Repair and replace defective parts. Replacing defective parts is the highest form of fire prevention. A true craftsman will not tolerate worn or defective parts; but if the craft instinct is not sufficient to force you into action, you might remember the presence in the theatre of several hundred, or more, people who come to your theatre because they trust you.

NOTES *from the* SUPPLY FIELD

★

OPERADIO INTRODUCES NEW DUAL AMPLIFIER

A DUAL theatre amplifier which may be used as spare equipment in case of a breakdown has just been announced by the Operadio Manufacturing Co. of St. Charles, Illinois. This equipment is known as Model 64.

The Model 64 provides two complete, independent sound amplifiers with self-contained power supplies. Control facilities make it possible to shift from one amplifier to the other amplifier in thirty seconds, in event of a tube or amplifier failure.

At first indication of impaired reproduction the projectionist may shift to the reserve amplifier. If the trouble is not cleared up and still remains after changing to the other projector, the cause is definitely localized in the stage speakers or their leads. Thus a theatre using this amplifier having two projectors and more than one speaker, each with separate field excitation, may feel safe from program shutdowns.

The amplifier supplies in a single unit everything for the sound system between the sound-heads and the stage speakers. It is entirely A. C. operated and provides both p.e.c. voltage and exciter lamp current.

ANDRE DEBRIE N. Y. OFFICES

The American affiliate of a long established French company, Andre Debrie, Inc., of America, has opened a service department and offices at 115 West Forty-fifth street, New York.

Included among the equipment on display are noiseless studio cameras, rolling tripods, sound printers, with pictures and titles superimposed in one operation; 16 mm. sound and picture printers, developing machines, all types of laboratory equipment and portable sound on film projectors.

LEADING 16 MM. COMPANIES AGREE TO MAINTAIN STANDARDS

RCA-VICTOR COMPANY, Bell & Howell, and the International Projector Company, leading manufacturers of sound reproducing equipment, and Eastman Kodak Company, the largest producer of sixteen millimeter film, have individually decided to maintain the present standard size 16mm. film in the production of sound-on-film motion pictures by eliminating one of the two rows of sprocket holes and by utilizing the space thus acquired for the sound track.

Interchangeability

In maintaining this standard and by the elimination of one row of sprocket perforations, the dimensions of the picture on the film remain the same as on the present 16mm. silent film. Present stocks of silent film can be run on sound projectors for the new film. The center line of the sound track is located centrally in the space between the picture and the edge of the film, the space thus available permits a sound track .065 inches in width and suitable margins on each side of the sound track.

The standard speed of 16mm. sound film is 24 frames per second and the lead of the sound with respect to the picture is 25 frames in advance.

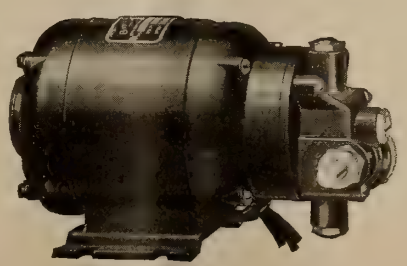
BODINE FRACTIONAL H.P. MOTORS WITH OR WITHOUT SPEED REDUCERS

A NEW line of fractional horsepower motors has been announced by the Bodine Electric Company, 2264 W. Ohio Street, Chicago, Illinois, which includes the type NSY-12 self-starting, single-phase, synchronous motor in ratings of 1/75 h.p. in the open ventilated frame, and 1/150 h.p. in the totally enclosed frame at a motor speed of 1,800 r.p.m.; and the type NSI-12 induction motor in ratings of 1/50 h.p. in the open ventilated frame and 1/70 h.p. when totally enclosed at a motor speed of 1,725 r.p.m., and 1/100 h.p. in the open frame and 1/150 h.p. when totally enclosed at a motor speed of 1,125 r.p.m.

Worm gear speed reducers are available with the following ratios: $8\frac{1}{2}$-1; 17-1; 30-1; 35-1; $72\frac{1}{4}$-1; $144\frac{1}{2}$-1; 289-1; 595-1; and 1,120-1; other ratios are available if required.

The new motors are built in aluminum die cast three-piece frames with separable gear heads, finished in baked black enamel. Nitralloy steel shafts running in sealed-type ball bearings are used for the rotor with the worm gears cut on the shaft. Laminated bakelite gears are used in the speed reducer. The motor weighs $4\frac{1}{2}$ lbs., has an overall length of 6-5/32 in. and a diameter of 3-21/64 in. The slow speed drive shaft is 5/16 in. in diameter.

These motors are used extensively for instruments and control apparatus. For installations requiring precision of speed, the type NSY-12 synchronous motor provides an ideal power drive. Where precision of speed is not so essential, the type NSI-12 induction motor is used. All regular synchronous or induction types are furnished as capacitor start and run when required. Shaded pole unidirectional or reversible units, four or eight poles, are also available in these frames.



One of the new Bodine motors

NEW W. W. PROJECTION REEL

The W. W. Specialty Company of New York has announced a new all-aluminum reel which is expected to be the outstanding item in the W. W. line. The new reel, which, like all W. W. products, is designed by a practical projectionist, will be more rigid and durable and is warranted to stand up under extra heavy usage. Specifications and prices of these new reels will be announced shortly.

NEW GIANT SCREEN FOR N. Y. PARAMOUNT

THE largest Chromolite sound screen ever made was installed in the Paramount Theatre, New York City, recently. The picture surface of the screen measures 31-0, x 43-0, a total of 1,333 square feet.

A full length picture of a man filling the screen from top to bottom will show him as about thirty feet tall; each of his shoes will measure about five feet in length; his middle finger will be about nineteen inches long; his eye will be larger than an average face; the mouth from corner to corner will be nine inches wide. He will measure across the shoulders approximately six feet; a button on his coat will be about three inches in diameter.

A 30-Foot Screen Face

A closeup of a face filling the screen will be about thirty feet from chin to top of the head. Each eye will be about forty inches long; the mouth about eighty-four inches from corner to corner; the nose will be about one hundred inches long. In spite of the immensity of these figures the optical illusion is such that the audience will not be aware of the tremendous size of the figures.

DEBRIE REDUCTION PRINTER FOR 8 M. FILM

IN line with the new Eastman Kodak 8 mm. camera and projector, Andre Debrie of Paris has developed a new printer to reduce 35 mm. film to 8 mm. Two 8mm. prints are obtained at the same time with the 16 mm. film being used as a printer. The film is split after development. This equipment is an extension of the Andre Debrie Laboratory line for sub-standard film, outstanding of which are the small developing machine —7 ft. long, 6 ft. high and 3 ft. wide— and the perforating machine for 8 mm. film. Distribution of all this equipment is through Andre Debrie of America, Inc.

The Debrie list includes many items for the projectionist and the photographer.

STEP-BY-STEP SERVICING OF SOUND EQUIPMENT

(Continued from Page 17)

the older units, however, the light slit is movable, so that a rotational adjustment is necessary to obtain maximum output from a given sound track and to avoid distortion.

This adjustment is effected by using the same tools and methods employed in making the focal adjustment. With a 9,000-cycle parallel line track running through the gate, the aperture plate is rocked back and forth by means of a vernier extension rod until maximum reading is obtained on the output meter, at which point the plate is then fixed by tightening the set screw. By the use of this method, the light beam may be adjusted to within one-half a degree of the horizontal lines on the sound track.

The frequency test track, which follows the 9,000-cycle parallel line track, is used to obtain overall output characteristic curves for the sound head and amplifier. The output response obtained in this way could be calibrated so that the curve may be plotted in volts, in decibels, or as a percentage of output at a given frequency. In the case of the multitester, it is found convenient to plot output curves as a percentage of the output voltage at 1,000 cycles. Fig. 4 shows a characteristic output curve corrected for slit losses.

The frequency test track is also useful for locating the causes of rattling or buzzing of speakers. Among the various frequencies included in the frequency track, there will be one that will correspond to the natural frequency of the loose wire or part, so that it will start to vibrate. The faulty element, having thus been located, may then be tightened or adjusted.

Special Test Film

The foregoing covers the description and uses of the recording on one edge of the standard test film. On the other edge of the film is a series of recordings of various musical instruments, and masculine and feminine voices, each section of the track being a special test for some particular characteristic of the equipment. The first in line is a piano solo track expressly intended for checking and determining by ear the extent of "wows" in the reproduced sound. The composition of this piano solo includes sustained notes that exaggerate the "wows" in reproducing equipment. All the necessary adjustments for the elimination of "wows" and "flutters" is performed during the playing of this selection.

A flute solo follows the piano solo. This recording may be used in a listening test as a check to determine the adjustment of the optical system, and the

possible presence of sprocket "flutter." It may also be used to locate loose metal or wooden parts in the vicinity of the stage loud speaker that may vibrate in sympathy with reproduced sound.

The flute solo has an abundance of slurred notes in the high frequency range. In the listening test, a lack of brilliance, crispness, or definition, particularly in the higher frequency range, will indicate that the optical system is out of adjustment. Sprocket "flutter" or improper gate and optical system adjustments are indicated by a "fuzziness" of the high frequency notes.

Two violin selections and one cello selection are next. One violin selection is a standard RCA Photophone variable width recording; the other is recorded with RCA Photophone anti-ground noise track. These selections are used to determine, by ear, the frequency balance using the cello to check the response at the low frequencies, the standard variable area muted violin record to check the middle range, and the anti-ground noise violin record, as well as the flute record, to check the upper range.

Vocal solos and dialog are next; these are used to check for intelligibility, clarity, and naturalness of reproduction. They provide a good test for the middle range of frequencies, which have the greatest influence on the intelligibility of speech.

The above outline briefly covers the standard methods employed today in testing and maintaining sound equipment. In the present state of the art, it is difficult to predict the oucome of the present trends in the design of sound equipment.

Manufacturers recognize the desirability and are striving for further simplification of the equipment. At the same time, there will have to be a decided improvement in the standards of sound quality to meet the demands of a public that is becoming more and more discriminating and instead of eliminating adjustments, it may be necessary to add to them or to refine the present test methods to meet the new standards.

For the present, at least, it goes without saying that any sound system, the servicing of which does not include meticulous care and complete periodic checks with adequate instruments will not, week in and week out, give the high quality of reproduction increasingly demanded by the theatre-going public.

COAST AGREEMENT SIGNED

A two-year agreement, providing for a closed shop in independent studios and back wage scale for sound men, has been signed by the Independent Producers' Association with I.A. sound men. This averts the general strike in all independent studios that loomed earlier in the month.

PROJECTION PRIME THEATRE PROBLEM, SAYS EXHIBITOR HEAD

(*Continued from Page* 2)

fact, *it is the only thing that counts.* I do not care what technical theories are involved; the only thing that interests the exhibitor is what he shows to his patrons. The exhibitor is the agency of contact between the public and the industry . . . . he must be able to look at the picture on the screen and see the product as a finished job.

I should like to make a few simple suggestions. If it were possible to change the height of the aperture so that more action could be photographed on a given length of film, a saving of 15 or 20 per cent would be effected in raw stock. The saving would be considerable also to the exhibitor, in costs and expressage. No one can say that if 200 feet could be the standard, it would not be more effective than 500; with half the number of reels and 1,700 feet of film equivalent to 2,000, the film expenses could be cut in half.

Wide Film and Color

Grandeur film is too wide; the large size of the image interferes with the creation of the intimacy desired between the picture and the audience. The same is true of the large screen. Why can we not agree upon a size of picture somewhat larger than the one we have at present—say, in the ratio of 1 1/3 for the width to 1 for the height? Concerning color, one of the greatest problems in dealing with colored pictures is that of obtaining good results on a flat surface; a three-dimensional process would assist materially in solving this problem.

If these things were given to us singly, today, I am afraid they would be of no use to us. If it is the intent of the engineer to release such developments, I would like him to delay doing so, and to realize color and stereoscopy in a process that is economical and to which our existing equipment can be adapted. When all these improvements can be given us at one time and with little cost, then they will be most welcome and beneficial.

Fire Prevention Tips

All equipment should be kept in a constant state of repair. *Worn and defective parts constitute a major fire hazard, and the projectionist who knowingly works with defective equipment is perpetrating an injustice upon the audience, which is in his safe-keeping; upon his employer, upon himself and his organization.*

RE-SURFACING PROCESS IS CITED BY S.M.P.E.

Re-surfacing of motion picture screens by theatre personnel usually leads to unsatisfactory results, according to a report of the Projection Screens Committee of the S. M. P. E. Tests made by the Committee showed that less reflection properties are restored to the screen when resurfaced by the theatre than when they are re-surfaced by the manufacturer.

The tests showed that the reflection factor of 85 per cent possessed by a new diffusing type screen is reduced to 60 per cent after two years of use. When this screen was re-surfaced by the exhibitor its reflection factor is increased to 65 per cent; but when the same screen was refinished by the manufacturer the reflection factor was increased to 82 per cent, or only 3 per cent less than its original factor of reflection.

"At first," says the report, "we were hopeful that surfaces could be renovated satisfactorily by spraying and painting

with screens in place. However, it is our present opinion that re-surfacing has not been generally successful as yet. It requires skill and expérience and even much care still leads to non-uniform reflection and cloudy effects which are obtrusively apparent. Whether or not methods will be later devised to eliminate these difficulties is problematical."

IMPORTANT LABOR DECISION BY N. Y. APPEALS COURT

RIGHT of a union to picket theatres is upheld in a ruling of the Court of Appeals, reversing injunctions obtained by the Stillwell Theatre, Rosekay Amusement Corp. and Windsor Circuit Corp. in New York against Sam Kaplan and Local 306. The theatres involved are now using men belonging to the Empire State Motion Picture Operators Union, Brooklyn.

The court's opinion, written by Chief Judge Pond, said that to bar lawful picketing "would be to give one labor union an advantage over another by prohibiting the use of peaceful and honest persuasion in matters of economic and social rivalry, and this might strike a death blow to legitimate labor activities."

Right of a union to picket theatres which was upheld by the New York State Court of Appeals, will be taken to the United States Supreme Court by the Empire State Motion Picture Operators' Union, of Brooklyn. Empire will base its move on the one dissenting opinion, handed down by Judge O'Brien, of the Appeals Court, in which he cites as precedents several similar cases, including the Hitchman decision.

PROJECTION ON CLOUDS

The phrase "All the world's a stage" has found a counterpart in Berlin, Germany, in "All the sky's a screen." Dr. Mannheimer, an engineer, has invented an apparatus which makes possible the projection of motion pictures and advertising on clouds or on mountainsides.

The projection machine is only four feet long. The light, by means of a mir-

ror arrangement, is thrown as far as that of an ordinary instrument extended 130 feet. On low-hanging clouds 230 feet above the earth the figures appear 130 feet in size. The only requisite for a show is a cloudy sky.

Two of the projectors have been sent to the United States and Switzerland.

MANY UNUSUAL FEATURES IN RADIO CITY THEATRE

FOUR standard size Photophone reproducing units, an 80-watt double channel amplifier in the projection room, and four 50-inch loud speakers on the stage will be used in connection with the reproduction of sound pictures in the new Radio City (N. Y.), theatre. In addition there will be a public address system, with twenty-five microphones, to reinforce the stage productions.

Unusual features of the installation include a rehearsal system for use in connection with the direction of productions; a stage manager's call system and fifty-two "Acousticon" seat phones, attached to selected seats for the benefit of the hard-of-hearing. Complete radio and phonograph equipment in the projection room will make it possible to transmit radio or phonograph programmes to the audience at any time.

The rehearsal system is said to be the latest development of its kind. With it the stage director, carrying a microphone, may conduct his rehearsals from any position in the auditorium of the theater, through the medium of loud speakers on the stage.

The stage manager's call system is another innovation. It enables the stage manager to communicate with any part of the theatre through a microphone on his desk.

Don't fail to oil the pad rollers.

Don't fail to see that all pad rollers are turning when machine is in motion.

Don't fail to keep rollers in upper and lower magazine roller holders clean and well lubricated and rolling.

Effect of Motion Pictures on the Eyes

(*Continued from Page* 13)

fortable to look upon. In some of the cheaper picture houses they are used much too long.

The position which the observer occupies in relation to the screen contributes very much to the eye comfort. If he is too close to the screen the pictures become blurred and confused, and defects are emphasized. The same effect is produced if the picture is viewed from too great an angle from one side or the other. Sometimes these nearer inferior seats are cheaper and are occupied by children whose eyes are more easily harmed by the resulting strain than would be the eyes of older people. Children should not be allowed to occupy these less desirable positions. The best place from which the picture can be viewed is near the center of the hall and directly in front of the screen.

Good Sight a Requisite

The final requirement, if the film is to be seen without discomfort, is that the eyes of the observer shall be functionally normal and of good visual acuity. When in the absence of any of the defects above mentioned—in the screen, in the eveness with which it is shown, in the illumination and in the position of the observer—there is still a consciousness of strain which is not occasional but persistent, it is safe to assume that there is present some ocular defect that should be corrected. It may be focal or muscular but it will be found that any other continuous use of the eyes will be equally discomforting. In that event the eyes should be examined in order that the defect may be found and corrected and the prescribed glasses worn.

In a recent inquiry which was instituted by Professor De Feo of Italy, and presented at the annual session of the League of Nations, opinions were secured from leading eye physicians throughout the world, including Professors Van der Hoeve of Holland, Ovio of Italy, de Lapersonne of France, de Grósz of Hungary, Angelucci of Italy, and other of equal eminence. The agreement was general in the views expressed above.

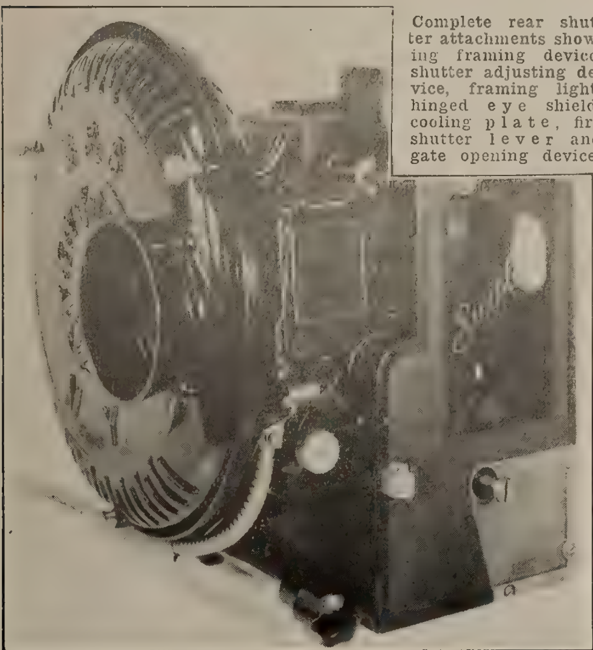
Summary of Survey

The following conclusions, therefore, seem warranted: that under normal physiological conditions, moving pictures do not cause serious eye fatigue; that since viewing moving pictures is distant vision it does not demand so great an ocular effort as near vision—such as reading for a corresponding length of time; that when eyestrain is caused by moving pictures it is due to one or another preventable condition such as too prolonged fixing of the attention on a single point, or defective visual function, to a bad position of the observer in relation to the screen, to poor films, improper manipulation of the apparatus, to faulty projection or to improper illumination. With these reservations there is no more harm to the eyes in viewing the moving pictures with modern improved methods than there is in any other normal use of the eyes.

Fire Prevention Tips

A projectionist should formulate and then religiously adhere to a fixed routine relating to protective measures. First and most important is the strict necessity for the exercise of the utmost care in handling not only film but every piece of equipment in the projection room. Next in importance is his duty to keep his equipment scrupulously clean and free from any substance or refuse which might constitute a fire hazard.

TWO NOTEWORTHY ACHIEVEMENTS IN PROJECTION EQUIPMENT



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B. & S. Rear Shutter

reduces aperture heat by 70%, minimizes effect of warped and buckled film, and keeps film free from dust and dirt. Exclusive blade feature of this shutter keeps hot air from film and insures constant supply of cool air around the aperture. The results of a test by the Massachusetts Department of Public Safety in a Boston theatre on January 19, 1930, are as follows:

Without B. & S. Rear Shutter
Aperture Heat: 1250° F.

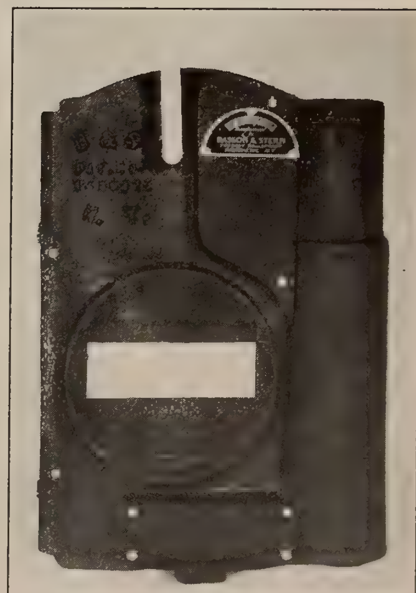
With B. & S. Rear Shutter
Aperture Heat: 340° to 350° F.

Installation can be made in one hour on any single- or double-bearing projector mechanism, without any cutting or drilling. Periodic oiling is the only maintenance requirement. Rear shutter equipment includes cooling plate, framing device, shutter timing adjustment, and a framing light. A hinged eye shield permits easy accessibility to the mechanism.

B. & S. Change-over

consists of two shutter blades contained in a housing designed for attachment to the cone of the lamphouse and operates on either A.C. or D.C., at 110 to 125 volts. Novel design eliminates any possibility of double exposure on the screen, and makes the change invisible to the audience. B. & S. Change-overs operate efficiently on either A.C. or D.C., but coils for the proper current will be supplied on specification. Coils of the B. & S. Change-over will stand up under heavy overloads and will not burn out.

The constant arcing in an ordinary change-over switch soon causes the metal contacts to burn and corrode. All B. & S. switch contacts are made of carbon that cannot corrode. B. & S. unique design also prevents the flash from touching any part of the switch. This switch cannot stick or bind and is positive in operation. B. & S. Change-overs have been used for many years in Publix, R-K-O, and other major theatre circuits.



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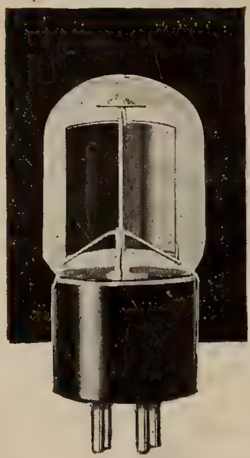

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Edited by James J. Finn

Vol. 3, No. 3
September 1932

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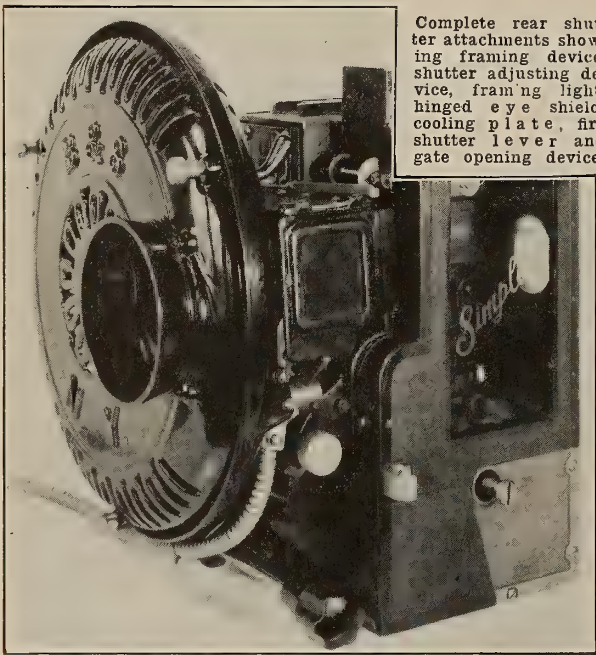
TWO NOTEWORTHY ACHIEVEMENTS IN PROJECTION EQUIPMENT



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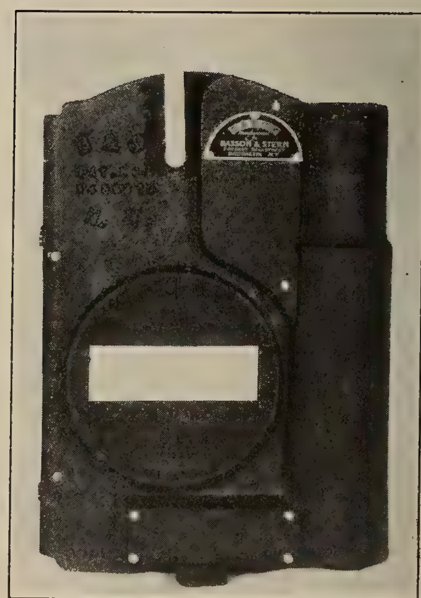

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Edited by James J. Finn

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MONTHLY CHAT

THIS month we offer great gobs of very readable and very valuable information. The best variety of ye olden vaudeville show hasn't a thing on us, as even a casual perusal of our pages will prove. Which is exactly as it should be and exactly what we have often said a real live craft paper should be. Tall doings in New York City are reported in detail. Read every word. George Yager of L.U. 250, Salt Lake, scores a hit with some very pertinent comment anent work, wages and safety. As we expected, M. D. O'Brien, of Loew Theatres, defaulted on his assignment—but only until next month. After all, what can one expect from a projection supervisor? Nothing, just nothing.

WE'VE had a lot of fun editing this exhibitor comment on projection matters. Our blue pencil has cut many a searing word relative to exhibitors; and now that Mr. Exhibitor has his say, he deals out nothing but kind words to the projectionist slaves. Just a case of turning the other cheek, we think. The more rabid I.P. clientele likely will shout lustily: "Conspiracy!". To which we'll turn the other cheek and advise a careful reading of Charles ("Chick") Lewis' article in this issue. What a man he is! *what an exhibitor!*

NOW that the new aperture has been introduced all around, there is considerable chatter current regarding the relative merits of square and round corners for screens. Personally we like square corners; many of our friends prefer the roundies. Palpably a matter of personal taste, our liking for the square corner is based on the notion that there is something decisive, something all-inclusive about a square screen; while the round corner seems to invite the eyes to stray off the edges of the picture and wander about. We just *know* that some up-and-coming technician is going to try to explain this matter by handing out a big dose of psychology—but even after he has finished his argument, we still will vote for the square picture.

BOOKS could be written on the one-man vs. two-men sound shift situation (although the sale probably wouldn't exceed 58 copies, C.O.D.). Still, we are forced to admit that after a trip to Columbus (which, you will recall, was to have settled this question) and after listening to several oracles discourse on this topic, we have to report that not a single sane argument has filtered through the smoke to our ears. Just to show how smart we really are, and to give aid and comfort to our thousands of palpitating readers, we shall present in these columns next month *our* idea on two-men shifts. It's all really very simple: there are four solid arguments, airtight, too, and we shall discuss each and every one in detail. On the right, please.

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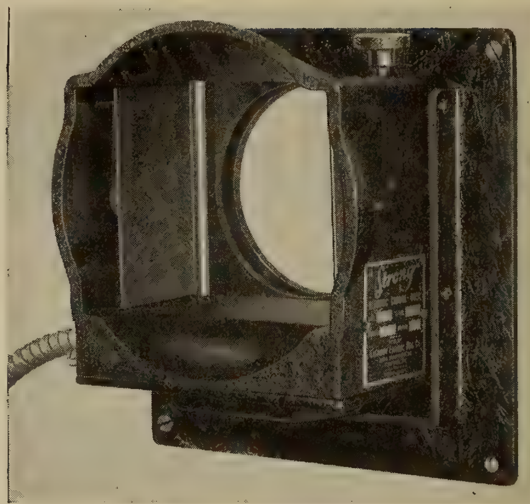

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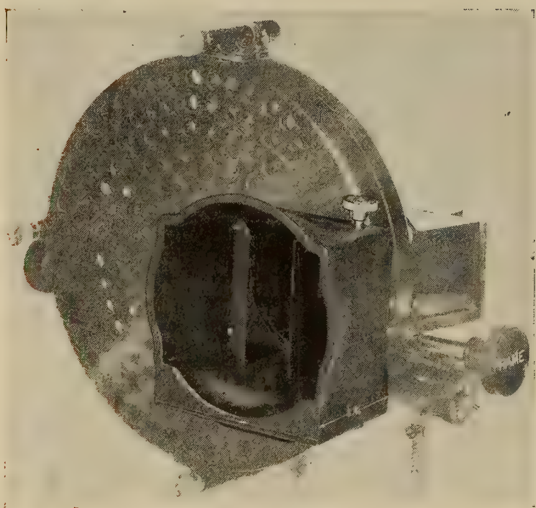

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INTERNATIONAL PROJECTIONIST

VOLUME III NUMBER 3

SEPTEMBER 1932

VACUUM TUBE ACTION AND METHODS OF TESTING

A. C. Schroeder

MEMBER, LOCAL UNION 150, LOS ANGELES, CALIFORNIA

THE vacuum tube is the one thing that has made the sound picture commercially possible. It can be termed an electrical trigger, or a relay; a voltage applied to the grid *controls* a much larger amount of power in the plate or the output circuit. The tube does not change the small voltage into a greater amount of power; that would be a form of perpetual motion. The charge on the grid is used only to govern the amount of current that flows in the plate circuit, much the same as an engineer controls the enormous power of a modern locomotive by merely opening and closing the throttle with a comparatively small lever.

The sound recorded on the film is assumed to be free from distortion and it should be reproduced the same way, that is, so it sounds natural—or should we say, "as the original sounded." If we have a sound track that meets these requirements, we must also amplify it so that all the characteristics remain the same, with the exception that the magnitude of the sound wave is made greater; it becomes "louder" as it passes through the amplifier. (Actually there is no sound in the amplifier, or anywhere else until the sound sensation is produced in the brain.)

"Sounds" put through the amplifier are electrical currents of varying intensities. It has become customary to speak of these currents as "sound," and it is a convenient term, describing quite well what we have in mind, much the same as when we speak of "sound-on-film."

Function of the Tube

To properly reproduce sound the tube must pass the signal on to the next device just as it was impressed on its grid, only in a magnified form. To do so the tube must be in a normal condition: the filament, grid and plate voltages must also be normal.

When the tube is not amplifying properly it introduces harmonics causing it to sound fuzzy or raspy; some call it a form of flutter. The volume also drops, as a rule. Looking at Figure 1 we can see why this is so. The wavy-shaped line might be called a picture of the sound. The full line shows how it would be if the reproduction were perfect; the dotted line shows what happens when the tube is not capable of amplifying properly.

At the point marked X the curve shows the plate current of this particular tube to be some value, say 20 mils. The full line at Y shows the current to be 40 mils when everything is normal, but when the current at Y is of a value as shown by the *dotted line*, 35 mils, the reproduction is no longer the same and the sound coming from this stage is distorted.

Let us see why the shape of the curve is changed. The filament must be capable of throwing off enough electrons to supply any normal demand made on the tube—that is, when the plate current is at a maximum, as shown by the solid line at Y, there still must be many more electrons thrown off by the filament than are needed by the plate, or than the plate can attract, so that the plate current cannot approach the saturation point, which is the point where all the electrons thrown off by the filament are attracted to the plate.

The Saturation Point

When the maximum plate current is of a value comparatively remote from the saturation point, the shape of the curve will be as shown by the full line. If the tube is a poor one, with low emission, the saturation point is reached, or nearly reached, before the plate current increases to what would be the normal peak value. The result is shown by the dotted lines.

The same thing happens when the filament current is too low. The number of electrons thrown off is again reduced; the plate current reaches the saturation

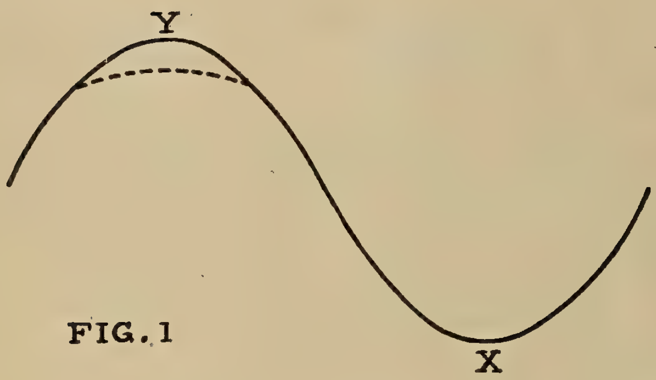


FIG. 1

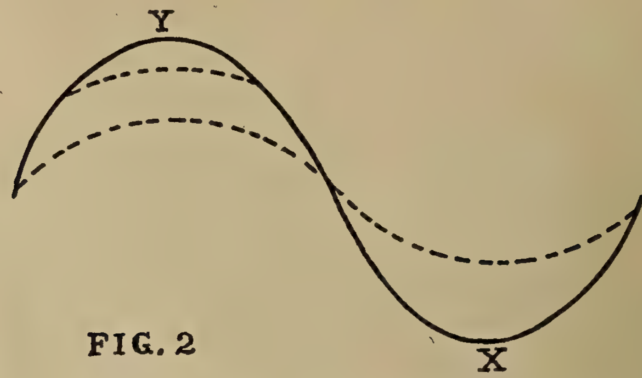


FIG. 2

point, but this time because the filament is not heated sufficiently.

Improper plate and grid voltages have similar effects. Consequently it is very important not only to have good tubes in the amplifiers, but also that the applied voltages be of the correct values.

Let us consider a tube with low emission. If the signal is of a small value, so the plate current can follow the signal without getting too close to the saturation point, then the amplification will be without distortion, even with a poor tube. In Figure 2 this smaller signal is shown by the dashed line. The curve of Figure 1 is repeated here to show how the smaller signal compares with the one described previously.

Notice that the normal peak of the smaller signal does not go as high as the distorted peak of the large signal shown by the dotted line. This gives rise to another thought: if there are no spare tubes on hand, or if the spares are all poor ones, they can often be used in the earlier stages of an amplifier even though they are not capable of perfectly amplifying in the final stages. It also brings to mind the fact that the best tube available should be used in the third stage of the 41-A amplifier. The same is true of the voltage amplifier in an RCA set. Use the two best tubes in the third stage. Other amplifiers using the same type tubes in more than one stage should be treated accordingly.

Proper Voltage Values

When the amplifiers are equipped with meters it is easy enough to see that the voltages are kept at the proper values. Quite often it is not possible to read the plate voltage, but this does not matter, as the proper flow of plate current is an indication that the voltage must be correct.

If the plate voltage and the grid bias voltage should both be wrong at the same time, there would exist a condition where the plate current *could* be of the correct value but the tube would be distorting. This fact would be quickly shown, however, by the plate current meter, because, even though the plate current would be normal when no signal was being put through the amplifier, as soon as a signal would be applied to the grid, the meter would wiggle back and forth more or less violently, unless the signal is very small. This is a good thing to watch anyway, to see if the stage is amplifying as it should.

It is generally considered that the plate current can vary as much as 10% without producing any *noticeable* distortion in the sound. However, it is desirable that the meter be steady. You will notice on making this test with a poor tube that the meter will become steady when the volume is cut down, unless the tube is entirely gone. As the volume is again increased the needle starts to wiggle more and more, each loud note or word causing the needle to jump.

With a good tube in the socket, but with some of the voltages having wrong values, the meter acts the same way. It must be borne in mind that even a good tube, having all voltages normal, will give a similar indication when the tube is overloaded. Any tube is capable of handling a signal of only a certain magnitude; when this is overstepped the tube overloads and the meter starts to wiggle. This is a perfectly normal condition, so some judgment must be used when making this test.

On ordinarily loud reproduction none of the tubes should overload, and the plate current meter should remain steady. On extremely loud shrieks, crashes, etc., it is allowable that the needle make quite large excursions from the normal. However, when the needle moves at all while the volume is kept at the average level, something is wrong, and the most likely point of trouble is the tube.

RCA System Amplifiers

When no plate current meters are supplied with the set, it is not so easy to see what or where the trouble is. When there are two voltage amplifiers in the installation, (as have many RCA equipments), the first thing to do is switch to the other amplifier. If the trouble clears up, this quickly shows the trouble to be in the first amplifier. Should the trouble remain, it is probably in the power amplifier. If there be two or more power amplifiers, the monitor is plugged into one of the others. This will give good reproduction in the monitor when the trouble is in the amplifier that had previously been connected to the monitor.

If the trouble has been narrowed down to one of the power amplifiers, see how the tubes look in that amplifier. If any of them look abnormal, they should be replaced. If such is not the case, they must be replaced one by one, until the trouble is corrected or all the tubes have been exchanged for good ones—showing something else to be wrong.

Usually the only visual indications of a bad amplifier tube in the RCA power amplifiers are too much blue glow or the plates being red hot. When the plate of one rectifier tube is cool and the other rectifier plate is red, the one with the cool plate usually is no good. The same is true of the amplifier tubes. When the plates of both the amplifier tubes and both the rectifier tubes are red hot at the same time, some other part of the amplifier has developed trouble.

NEW CURTAIN TRACK FROM AUTOMATIC DEVICES

AFTER a long period of development and installation under actual operating conditions, Automatic Devices Company of Allentown, Pa., has recently announced the new Steelite light-duty curtain track. A large number of theatres, schools, churches and similar auditoriums of modest size are limited in their appropriations for stage draperies and heretofore have been compelled to use home-made wooden curtain tracks or other unsatisfactory travelers to keep within their budget. Use of Steelite removes these restrictions by offering a steel track with all the advantages of rigid, fireproof construction at a cost as low as that of the troublesome wooden traveler.

The Steelite track is distributed by drapery houses and equipment dealers throughout the country and samples will be gladly sent upon request to Automatic Devices Company, Allentown, Pa., manufacturers of Silent-Steel heavy-duty curtain track, Allentown automatic curtain machines and Stabilarc motor-generators, well known in the film industry.

FILM STOCK: ITS NATURE AND APPLICATION

Super-Sensitive Panchromatic, Duplitized Positive Orthochromatic Negative, Tinted Positive—these are but a few of the many types of film stock available for use in motion picture production and reproduction work. Little more than a group of type names to most projectionists, the entire series of motion picture film stocks is classified and the various uses cited in this very interesting article.

THE competent physician is familiar with the surgeon's instruments, even though he himself does no surgery. The projectionist deals only in finished film, but the thorough-going practitioner in projectionist ranks may welcome an opportunity to clinch his knowledge of the tools used by the surgeons of the motion picture industry—those who, dealing not directly with the public through projection, specialize in the operations that make pictures.

Films of various types are the pliable tools of Hollywood and New York and Chicago. To satisfy projectionists' desires for fuller information about film, a glossary of the types, present and recent, is here offered.

Orthochromatic Negative. Until the introduction of panchromatic motion picture film, orthochromatic negative was in universal use for outdoor work and studio work. "Color blind" film is sensitive only to the blue, the violet, and the ultra-violet rays reflected from any photographic subject. Orthochromatic, in addition, is sensitive to the yellow-green, but not to the red. . . . Orthochromatic has been almost entirely superseded by panchromatic types of film.

Panchromatic Stocks

Panchromatic Negative. Panchromatic film is sensitive to the red, as well as to the colors which affect orthochromatic film. Improved photographic rendition of tone values results from sensitivity of film to the whole visible spectrum. Upon its introduction, panchromatic negative was used principally for outdoor work.

Panchromatic Negative, Type 2. Introduction of this film followed that of the original panchromatic. Greater speed made Type 2 "Pan" useful for studio work as well as out-of-doors, and this film quickly came into the most general use. Increased speed, in photographic terminology, means simply the ability to record an image with less light.

Super-Sensitive Panchromatic, Type 2. Introduced not quite two years ago, this type of negative material has in turn very largely superseded previous types of negative material. About three times as fast as Type 2 "Pan" under artificial light, Super-Sensitive gives equal studio results with very much less light, thus reducing heat, glare, and cost in motion picture making. Greatly increased sensitivity to red light is responsible for the trebling of this film's speed under artificial light.

Artificial light contains a higher proportion of red than does sunlight. But the fact that Super-Sensitive "Pan" is also faster out-of-doors has made it the most widely used all-purpose negative. In addition to the reduction of necessary lighting, the greater speed of this film makes greater "depth of focus" possible, which means that directors can move their actors about more freely without getting them out of focus. In spite of its great speed, Super-Sensitive "Pan" is even finer-grained than previous types.

Super-Sensitive Panchromatic (Gray Backed). With the same emulsion qualities as the original Super-Sensitive "Pan", the gray-backed type of film is not subject to halation around bright lights or brilliant spots in the picture field.

Positive. Theater prints are made on positive film with a nitrate base. Since speed is not an important factor in making prints, positive film is much slower than negative, with an emulsion composed of very fine silver-salt grains.

The Sonochrome Series

Tinted Positive. Before sound, tints were widely used for theater prints. With the advent of sound, the existing tinted positive became useless, because certain of the tints in the film base interfered with the passage of the light through the sound track to the photoelectric cell of the sound reproduction system. The Eastman Kodak Company overcame that obstacle by producing a series of seventeen "Sonochrome" tints which had a minimum of obstructing effect on the useful light passing through the sound track.

The purpose of the Sonochrome series of tinted films is to enhance, by inducing moods which are subconsciously associated with colors, the emotional significance of various scenes. Although gray, as projected by untinted film, may deepen certain moods of the screen, the peaks of emotion are usually flattened off by gray; whereas psychological tests have well established that colors do have certain consistent emotional effects.

Positive (Acetate Base). The so-called safety film is used for non-theatrical prints to be projected where no projection room is available.

Duplicating Positive. To guard against loss, as well as to speed up the making of prints, it is common studio practice to make duplicate negatives from finished original negatives. Of course it is necessary that a duplicate negative shall give a print which is a facsimile of a print from the original negative. To that end, special film is necessary both for the duplicate negatives and for the master positive which is the intermediate material used in making duplicate negatives.

Duplicating positive film has a lavender base, which serves the purpose of reducing halation effects in printing and which also serves for identification. The emulsion is capable of giving very fine-grained images with good contrast on full development. The "latitude" of the emulsion is such as to insure correct reproduction for the greatest range of tones likely to be met in an original negative.

Duplicating Negative. With sufficient printer speed so that enough exposure can be obtained through the dense master positive without changing printer lamps, duplicating negative film possesses, in common with duplicating positive, the qualities of latitude, fine-grained image with good contrast, and reduction of halation. In the case of duplicating negative, a yellow dye in the emulsion accomplishes the reduction of halation.

Two-Color Prints

Duplicate Positive. Coated with an emulsion on each side, this film is used for two-color prints. After a negative or two negatives, according to the process,

have recorded two sets of black-and-white images taken through light filters of complementary colors—usually orange and green, respectively—a printing device registers the two sets of images on opposite sides of the duplitized positive film. The two sides are then dyed in complementary colors exactly opposite from those of the camera filters—in other words, green and orange respectively.

White light from the projector, passing through the two-color film, then throws upon the screen a picture that has the appearance of natural color.

[NOTE: The foregoing presentation of data relative to types of motion picture film may suggest to projectionists certain other questions. Detailed information on the topics discussed in this article, or on other questions relative to film stock which may arise from time to time, will gladly be given in these columns.—EDITOR.]

Horn Placement and Porous Screen Encounter Stiff Opposition

PROJECTIONISTS as a group have never become reconciled to the mounting of sound system horns directly behind the motion picture screen. This objection by projectionists as practical showmen is two-fold: first, a horn mounting directly behind the screen occasions considerable trouble in sound transmission, and, more important (2) such manner of mounting necessitates the use of a perforated screen, which in turn results in a loss of about 40 per cent of the available light and prevents the employment of any effective screen cleaning method.

Perforated screens are opposed by every thinking projectionist. Carbon manufacturers have been hard put to it to satisfy the demand for more light on the screen, and optical companies have had their troubles in this respect, too. Increased amperage and better carbons have failed dismally to overcome the severe handicap of the perforated screen. Screen manufacturers themselves do not believe in the perforated screen, but their hands have been tied, so to speak, by the insistence of sound engineers that sound system horns be mounted directly in back of the screen.

Until very recently the question of horn positioning was more or less taken for granted; the sound engineers were permitted to make the decision, and projection results, insofar as screen picture quality was concerned, were left to tag along as best they could.

At the recent S.M.P.E. Convention in Washington, following the reading of the report of the Sound Committee, Mr. F. H. Richardson, well-known advocate of better projection, popped the question which led to a very interesting and illuminating discussion anent horn positioning. The discussion, which on the face of the record would seem to sustain the viewpoint of Mr. Richardson, is appended hereto:

MR. RICHARDSON; I am not convinced that there is any necessity of punching a screen full of holes, or of placing the horn behind the screen. The average audience would not be able to notice anything wrong if the horns were moved to the side of the screen instead of being placed at the center. Besides, the screen is difficult to clean when perforated.

Doesn't Matter, Says Goldsmith

DR. GOLDSMITH (President of the S. M. P. E.): Experiments in moderately sized rooms in the home with 16 mm. sound projectors indicate that the exact position of the loud speaker is a matter of comparative indifference. Assume a room approximately 15 to 20 feet, with the audience seated from 8 to 12 feet from the screen, the screen being 30 by 40 inches in size. The loud speaker is placed on the floor. Under such circumstances, the loud speaker can be directly under the screen, to either side thereof, or as much as 4 or 5 feet forward of the screen toward any individual in the audience without any protest or any apparent impression on the part of the members of the audience that the sound is not emanating from the characters on the screen.

The small dimensions of the room, the short times of acoustical transmission involved, and the general acoustical characteristics of the room no doubt contribute to this convenient result. Something of the same effect is found in large theaters for that portion of the audience who are not close to the screen. The exact location of the loud speaker seems to make less difference in this case.

MR. DOWNES (National Carbon Co.): The holes in the screen are responsible for the loss of a great deal of light, and we have demands for more and more light. We are reaching the point where it is difficult to obtain more light from the source, and if these holes could be removed, some of this difficulty would be avoided.

MR. KELLOGG (RCA-Victor Co.): I assisted in experiments at the General Electric Laboratories in some of the first efforts to make sound films. Perforated screens were not available. The loud speakers were either both on one side of the screen, or one on each side. This arrangement was very satisfactory for music, and at that time the reproduction of music was regarded as the chief requirement. When, at a later date, speech had become the chief requisite, some difficulties arose, especially when the effects of poor recordings and reverberant theaters were compounded. In the course of a series of tests for the purpose of improving the situation, we found that there was a definite improvement in the clarity of speech, when the sound came from a single source, instead of from two or more sources. With a single source, it becomes more important to locate it behind or over the screen. Although an audience may not in general be extremely critical of the location of the source, there are unquestionably times when the illusion will be marred if the sound comes from 10 to 15 degrees to one side.

MR. EDWARDS (Projectionist, L. U. 306): In the case of combination houses, the screen is raised and the horns are moved to provide stage room for vaudeville. As the vaudeville ends, the curtain and screen must be lowered, and the horn towers moved back to their original positions.

These operations have to be performed in semi-darkness in about 30 seconds, and it should be perfectly obvious that errors in placement can, and do, occur.

Horn Angles Changed

In ordinary picture houses, where the horns are supposedly permanently located, in numbers of cases the angles of the horns have been altered unintentionally by cleaners and others working back stage. These conditions are responsible for nine-tenths of the unsatisfactory sound distribution in theaters today. If it were possible to build the horns into the proscenium arch, it would obviate these difficulties without destroying the illusion and at the same time permit a much more satisfactory picture on the screen.

MR. DAVEE: The ability to locate sound is binaural. Most people are unable to hear equally well with either ear, and the ability of an audience to locate a sound is probably not accurate. It would be interesting to examine the ability of an average audience to locate sound sources and to apply the results of the study in locating the horns.

MR. SANTEE (E.R.P.I.): Perhaps that is why the location was determined as it is. While some persons could not tell whether the horns were behind the screen or not, others were able to do so. It was agreed that it was easier to listen to the sound when it emanated as closely as possible from the image of the characters on the screen. Otherwise, there would probably be an unconscious but continued mental effort exerted by the listener to make himself believe that the sound was emanating from the speaker's lips. The conclusion was reached that the logical place for the loud speakers was as nearly as possible behind the image of the head of the speaker.

Quality Not Considered

MR. GREENE (Projectionist, L.U. 219): If no complaints are made, it does not necessarily follow that everything is all right. I have never forgotten the remark of Mr. E. T. Clarke before this Society years ago: "Indignation and lack of in-

QUESTIONS AND ANSWERS ON PROJECTION SCREENS

Especially Prepared for *International Projectionist* by

R. T. Rasmussen

PRESIDENT AND GENERAL MANAGER, BEADED SCREEN CORP.

CONSIDERABLE misinformation has been circulated regarding the merits or demerits of various types of motion picture screens of both the silent picture and sound picture types. A majority of projectionists, not possessing the facilities for accurately checking on the various claims advanced for different type screens, have had to depend almost wholly on their own good sense in the selection of screens for their theatres. Most of the misinformation on screens has been broadcast by the major motion picture theatre circuits in the form of solemn pronouncements by well-meaning but misinformed projection supervisors, in circuit house organs, in bulletins and in "orders" issued by division managers.

The appended questions and answers, the first of a series to appear in these columns, are not intended to be controversial or to constitute a rebuttal of screen facts from other sources, but represent the results of careful tests conducted by competent workers using every modern testing facility.—EDITOR.

1. *What is a Sound Screen?*

A sound screen is a motion picture projection surface porous or perforated to allow free passage of sound from the speakers placed at the back of the screen.

2. *What is a Perforated Screen?*

A Perforated screen is a fabric, coated with white pigment. Holes are punched through the material at intervals averaging 5/16 inch. Each row of holes is staggered over the center of the adjoining row. The back is usually tinted in various colors. This color is for identification purposes only, and does not affect the projection quality.

Perforated screen fabrics are, essentially, what are known as Pantosote or Fabricoid. The base fabric is cotton cloth coated with a celluloise compound (celluloid). All perforated screens are essentially alike in construction and reflection characteristics. The largest bulk of this fabric is made by one manufacturer of Fabricoid materials.

The projection qualities and the useful life of a perforated sound screen, is, for all practical purposes, identical. The perforated space area averages from 5 per cent to 8 per cent of the whole area.

3. *What is a Porous Screen?*

A porous screen differs from the perforated type in that the sound passes through the screen via interstices in the woven cloth. In the Vocalite and Chromolite type of porous screens, there are also tiny eyelets woven in at ¼ inch intervals in staggered rows.

The area of sound openings in a porous screen ranges from 25 per cent to 30 per cent of the entire area. Porous screens offer no resistance to the transmission of sound, even at the high frequency ranges.

4. *What are the trade names of perforated screens now on the market?*

DaTone X	Walker
DaTone Z	RaTone
Datone B	Minusa
DaTone F.P.	Gardner
Superlite	Orthochrome

5. *What are the trade names of porous screens?*

Super Vocalite	Chromolite

6. *What is the difference between various perforated screens?*

There is no essential difference between perforated screens. The greater bulk of the base material is manufactured by one company to one standard formula. The light and sound characteristics of perforated screens are for all practical purposes identical.

Perforated screens range from 71 per cent to 79 per cent in brightness. It frequently happens that one panel of a screen will vary from 5 per cent to 10 per cent in brightness from one end to the other.

7. *What are the trade names of Beaded Screens?*

There are two beaded screens on the market:

Super Vocalite	Brightness percent	187
DaLite Beaded	" "	115

8. *What is a Metallic Screen?*

A metallic screen is a reflective type of screen using a cotton fabric base, coated with aluminum, or combinations of aluminum, mica and gold bronze.

9. *What is a Silver Screen?*

A Silver Screen is the same as a metallic screen except that the coating is aluminum only.

10. *What is a Gold Fibre Screen?*

The so-called gold fibre screen has an aluminum coating in which has been mixed various proportions of gold bronze powders giving the finished screen and the projected picture a yellowish golden tinge.

11. *What is a diffusive Screen?*

A diffusive screen is a white matt surface, which reflects light equally in all directions. Consequently, a person sitting at a wide angle with respect to the screen receives as much light as the person sitting directly in front.

12. *Where should a Diffusive Screen be used?*

In houses where the projection angle is greater than 20 degrees. It should as a rule always be used with hi-lo or high intensity lamps. A diffusive screen is best adapted to wide houses where a large proportion of the seats are at angles of 30 degrees or more with a line normal to the center of the screen.

It must be remembered, however, that *eveness* of reflected light is being secured at the cost of the *strength* or *intensity* of reflected light over the largest area of the house.

Advantages of a diffusive screen are: (A) It reflects a large percentage of the projected light. It is very efficient. (B) It is good for color projection. (C) It reflects the projected light through wide angles, giving satisfactory projection for wide theatres. (D) It is efficient in theatres with steep projection angles.

[There exists widely divergent opinion as to the relative merits of projection screens. Discussion of the questions and answers which appear herein, or additions thereto, are solicited.—EDITOR.]

(To Be Continued)

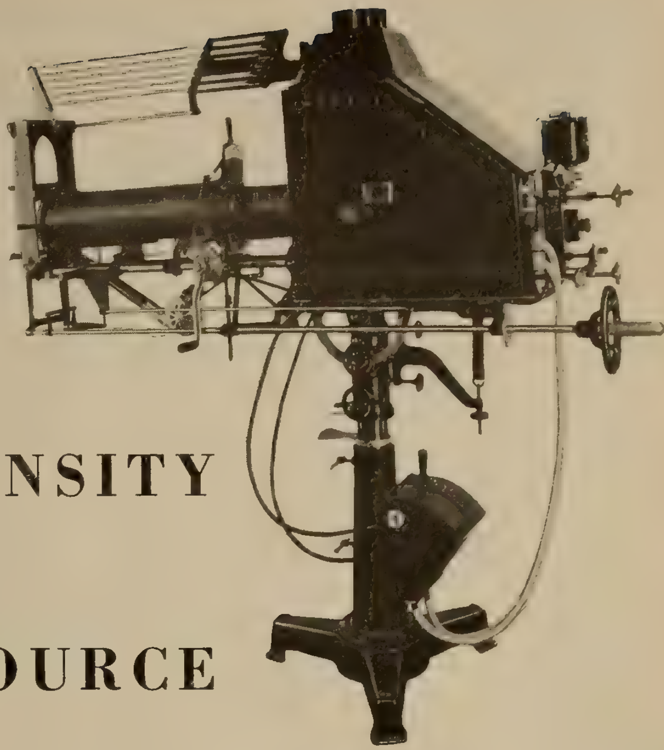
HORN PLACEMENT AND POROUS SCREENS

terest take the same form; people stay away."

As for the perforated screen—it may be clean, it may be white, yet if it is compared, from any normal viewing distance, with an unperforated piece of the same material, the latter will appear cleaner and whiter than the perforated sample. The perforated screen produces a sort of "half-tone" effect to even a sharply defined picture, and when this effect is compounded with a soft-focus effect that may look very artistic on a solid screen, the result is something that must be decidedly conducive to eyestrain.

As regards horn placement: some time ago, when the matter of attachment sound systems was being discussed in committee, one of the engineers exclaimed, "The trouble is that we are attempting to fit a precision instrument to a machine that is not a precision device." He spoke very truly. The trouble is that a precision industry is trying to fit itself to an industry—the exhibition of motion pictures—that is not a precision industry, and that apparently strongly resents any and all attempts to make it so. Almost any service engineer will admit that practically all the cooperation he receives from the exhibition phase of the industry comes from the projectionists. The majority of exhibitors are either apathetic or antagonistic. Many want service abolished altogether, want to sever all connections with the precision industry. Therefore, any recommendations that the Society may make as regards the placement of horns or speakers will receive but scant cooperation from the exhibition phase of the industry unless it effects a considerable saving. Quality will not be considered.

The name Preston R. Bassett and the term high-intensity arc are synonomous: no experienced worker in the projection field can think of one without thinking of the other. The accompanying article, a contribution by Mr. Bassett to a recent symposium on the carbon arc sponsored by the Illuminating Engineering Society, represents one of the finest contributions on arc lighting that has come to our attention.



The Hall & Connolly Spot, a modern high-intensity projection light source

THE HIGH-INTENSITY ARC AS A PROJECTION SOURCE

Preston R. Bassett

THE electric arc and the projection of light have always been closely associated. The first searchlight (1871), and the first motion-picture projector (1895), both utilized the carbon arc as the source of light. From those early days up to now, the arc in some form has always remained one of the essential projection sources.

The arc using pure carbon electrodes held the field for many years undisputed. The reason for this is very apparent. Light projection involves two elements—a light source and an optical system. An optical system has a definite focus, and therefore an efficient light source for projection purposes must have its light output concentrated in the vicinity of the focus. The unit of measurement of concentration is *intrinsic brilliancy* which may be expressed in candlepower per square millimeter of the light source.

Comparative Light Sources

Of the various types of light emission, incandescence, or the temperature radiation of solids, gives the greatest intrinsic brilliancies. It was a very fortunate circumstance for light projection that directed current passing between two carbon electrodes causes a portion of the surface or crater of the positive carbon electrode to become heated to a temperature of about 3,700 degrees Centigrade, which is the volatilizing point of the element carbon. It is fortunate also that carbon does not melt at this point but goes directly from a solid to a gaseous state. This makes a clean source.

The crater of the carbon arc at this temperature emits light of a brilliancy of 170 candlepower per square millimeter.

There was no other light source available that could even approach one-quarter of this brilliancy until about fifteen years ago. At this time there was a great deal of activity in the development and improvement of light sources of all types. The incandescent lamp with its coiled tungsten filament and inert gas was being concentrated and increased in efficiency so that it could enter the projection field. It entered not on the basis of competing with the arc in brightness but on the basis of simplicity—the elimination of working parts and the necessity of changing electrodes. The incandescent lamp, however, was limited practically to an intrinsic brilliancy of about 35 candlepower per square millimeter.

Another development which came into use at about the same time as the concentrated-filament projection lamps was the high-intensity arc. The high-intensity arc is more than an improved carbon arc. It is a new type of arc using as the light source a material which had hitherto never been used. The high-intensity arc also brought more refinement in mechanism and operation than the old carbon arc. It resulted, however, in providing a light source having an intrinsic brilliancy of from 500 to 1,000-candlepower per square millimeter. It was the first source of light which could be maintained in steady form that exceeded the carbon arc in brilliancy, which it did by more than 300 per cent. in one step.

The following is a table summarizing the brightness of projection sources:

	Candlepower per sq. mm.
Lime light	3-4
Tungsten Filament	20-40
Carbon Arc	150-180
High-Intensity Arc	500-1,000

In order to understand the action of the high-intensity arc, it is essential first to study the effect of amperage on the ordinary carbon arc. There is almost no mention in literature of the effect of current on the type of arc discharge. This current effect is so great that an experienced person can tell by observation, and with considerable accuracy, the amperes passing through an arc between the wide limits of 10 to 300 amperes.

Varying Amperage Effects

Figure 1 shows a series of arcs between ordinary carbon electrodes. In each succeeding sketch of the series the current is doubled. The progressive change of phenomena is evident. The 20-ampere arc is the familiar quiet little arc having the usual small yellow flame tip above the violet arc flame. The peak of the flame tip occurs about half way between the positive and negative electrodes. Doubling the current shows the violet arc flame almost unchanged, but the tail flame has increased in length and has shifted toward the positive electrode. Doubling again to 80 amperes causes the tail flame to lean back over the positive electrode so that its tip is no longer over the arc. It also increases in length to 4 or 5 inches. The arc is now apparently

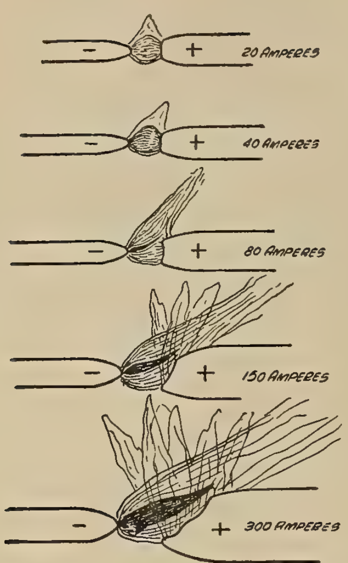


Fig. 1.—A series of arcs between ordinary carbon electrodes, showing effect of increasing the current

issuing almost entirely from the negative electrode.

The next step, 150 amperes, makes this very evident. The arc flame has now become a high velocity jet from the negative, which strikes directly against the positive crater. The last step, 300 amperes or over, exaggerates this negative blast condition to a point where the arc may be called unmanageable in practice.

The negative flame now acts on the positive electrode with a scouring effect, similar to placer mining. The crater is gouged out unevenly and, unless elaborate precautions are taken, the arc soon breaks into a roaring, shrieking arc due to access of oxygen to the uneven crater and also to the rapid thrashing around of the negative flame in an endeavor to cover a crater larger than its own cross-section.

Another important change in the arc discharge with increasing current is the shift from the familiar carbon vapor discharge, violet colored, to the enhanced brilliant white negative tongue discharge. The first appearance of the negative tongue usually occurs quite suddenly at about 80 amperes as a thin, white, central thread in the negative flame. As the current increases above this point, the cross-section of the negative arc flame remains almost constant, but the negative tongue swells in diameter and length. At a current of 600 amperes, the negative tongue fills practically the whole negative flame and the familiar violet arc flame is confined to a thin sheath surrounding it.

The "Pinch Effect"

The cause of the non-expansion of the cross-section of the negative flame with increasing current is the "pinch effect" in the conducting vapors. The "pinch effect" results from the self-inducted magnetic field surrounding the arc which acts on the arc stream as on parallel conductors and concentrates it to a current density which is the cause of the change of arc stream velocity and the type of discharge.

In the 20 and 40-ampere arcs, the flow of material from each electrode is intermingled and passes across the entire arc gap in both directions. It is the plating over of the positive material onto the negative tip which causes the well-known graphite cap or (in exaggerated form) the "mushroom" on the negative. In arcs of 130 amperes and higher, material no longer passes from positive to negative; hence the negative tip is always clean no matter what impurities may be in the positive. The increased velocity of the negative flame makes it impossible for ions to travel against it.

Arcs from 80 to 150 amperes show the transition stage from the commingled two-direction discharge to the single-direction discharge. Figure 2 demonstrates the backing out of positive ions. The positive electrode in this series is charged with a small amount of some compound which will color the arc flame, in this case cerium fluoride. These arcs are from original tracings made by lens projection of a magnified arc image on a screen.

All of the foregoing arcs consist of two separate discharges, the positive flame and the negative flame, but ordinarily these are not apparent as entities. In the low current arc they are intermingled and inseparable. In the high current arcs the positive flame is practically obliterated by the overpowering negative blast. But under special conditions their presence can always be demonstrated.

The ordinary flaming arc consists of an arc between electrodes, one or both of which are charged with chemicals which give the desired luminous effects to the arc flame.

Effect of Chemicals

Introducing the chemicals into the arc by means of an impregnated core in the positive electrode has been common practice since Bremer's original flaming arc lamps. The volatilized salt colors the arc flame with the distinct line and band spectrum of the elements used. Since the current used is always under 100 amperes in flaming arcs, the positive and negative flames are completely commingled and the chemical colors the entire arc flame as in the first sketch of Figure 2.

A calcium salt gives a yellow flame arc; Strontium, red; Barium or copper, green; Cerium, white, etc. The intrinsic brightness of these ordinary flaming arcs, however, is not as high as would be expected and they have therefore never been successful in projection work. The arc flame of any of the above mentioned arcs gives less than 10 candlepower per square millimeter.

When a certain class of chemicals is used to impregnate the core of the positive carbon, and the carbon is operated at a high current density, an entirely different type of arc discharge is noted. The positive core gives off a very brilliant blue-white flame which behaves quite unlike any other form of arc discharges. It is this flame which, when properly controlled, will give intrinsic brilliancies of 500 candlepower per square millimeter or greater.

Unless carefully fostered, the high-intensity flame has little strength or velocity but is flattened out or almost obliterated by the strong negative flame. By proper proportioning of the core and the shell of the carbon and by operating under definite conditions of current and electrode arrangement, the positive carbon can be made to form a deep crater in its burning end. This crater forms a protective housing for the brilliant high-intensity flame, and the negative flame acts as the cover which holds the high-intensity kernel in its crater.

High-Intensity Analysis

Taking the 150-ampere high-intensity arc as a standard, since it is the one most used, its structure and behavior will be analyzed in detail. The positive is 16 mm. in diameter and contains a core 8 mm. in diameter. All of the flame material, which is a cerium compound, is incorporated in this core, the shell being of the purest carbon obtainable with a minimum percentage of ash. The negative carbon is 11 mm. in diameter, and contains a small 3 mm. soft carbon or neutral core. A neutral core is one

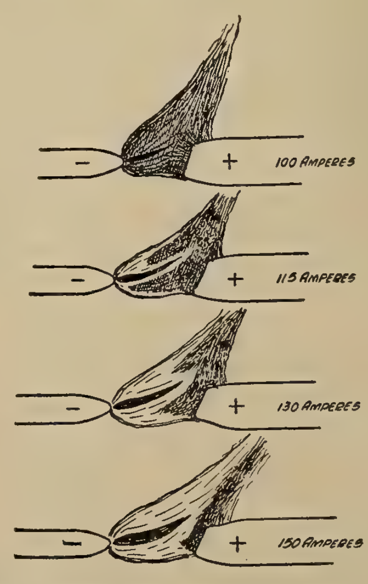


Fig. 2.—The transition stage from the commingled two-direction discharge to the single-direction discharge, demonstrating the backing out of positive ions.

which contains arc supporting but not light emitting materials.

The negative carbon is set at an angle below the axis of the positive. The positive carbon is slowly rotated.

When the arc is burned under these conditions, it appears as in Figure 3, which is a cross-sectional view. The positive carbon forms a deep uniform crater, which is of nearly the same diameter as the electrode. Both of these conditions, deep crater and crater diameter equal to the electrode diameter, are characteristic of the high-intensity arc and are produced and maintained in the following way:

The core containing the flame material becomes an excellent conductor at high temperatures and, therefore, almost all of the current enters the arc through the positive electrode core. Since the core burns away rapidly due to the high current density, the shell remains as a wall, which thus forms the deep crater. The electrode is consumed at a rate which is so rapid that the oxygen of the surrounding air has little opportunity of causing the electrode to spindle or taper on the outside.

By means of shrouding the electrode from the air up to within an inch of the crater and running at this abnormal current density, the crater diameter is kept very close to the electrode diameter. The continuous rotation of the arc keeps this crater wall uniform. The shell burns away to a sharp lip with concave inner walls, making almost a perfect hemispherical cavity. This uniform crater is essential to the high-intensity arc, since it acts as the container for the brilliant positive flame.

The percentage of flame material in the core, the current density and the shell and core ratio are so adjusted that the supply of the positive vapor is at all times sufficient to fill to overflowing this positive crater. The flame, in fact, bulges out in front of the crater and is only confined by the continuous pressure of the negative flame against it. The establishment of a considerable pressure exerted by the negative flame against the positive vapor is a large factor in the production of the increased brilliancy of the positive flame.

The continuous opposing forces exerted against each other by these two flames have a tendency to cause the flames to push each other aside, so that both may pass by each other without pressure. Any ordinary solid negative electrode will immediately give an unsteady crossed flame type of arc. Such an arc condition gives less than 50 per cent. of the candlepower of the normal high-intensity arc.

To prevent this condition it has been necessary to utilize a core in the negative electrode for the purpose of giving the negative flame such a directive force that it cannot be pushed aside by the counterpressure of the positive vapor. The 3 mm. soft core in the negative carbon makes a seat on which the negative flame tends to rest and from which it is only displaced with great difficulty.

Voltage Drop

There is considerable energy consumed at all arcs, the voltage drop is usually divided into three steps: (1) the cathode drop, (2) the drop through the arc flame, and (3) the anode drop. In the pure carbon arc, these are: cathode, 9 volts; arc flame, about 16 volts (depending on arc length); anode drop, 35 volts; total, 60 volts.

In the high-intensity arc the cathode drop is 9 volts and the drop across the negative flame is 16 volts, the same as in the carbon arc, but there is a drop of 37 volts through the brilliant positive flame in the crater and a drop of 13 volts at the core face or anode drop. The whole voltage drop within the crater is therefore 37 + 13, or 50 volts. Consider the current as 150 amperes and there is then 7,500 watts of energy concentrated within the ½-inch crater. This great energy concentration is largely responsible for the high temperature obtainable within the crater.

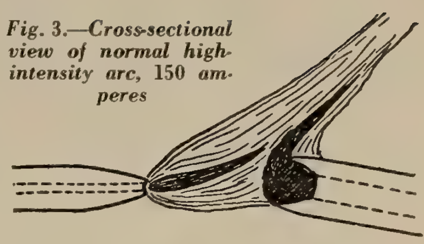
The other important feature of the high-intensity arc is to have chemicals available in the crater which can form compounds having very high volatilizing temperatures. Carbon volatilizes at 3,700 degrees C. and hence cannot give more than 180 candlepower per square millimeter, but certain carbides, such as the rare earth carbides, have even higher volatilizing points than carbon and it is the formation of these carbides that makes possible brilliancies so much greater than the carbon crater in the high-intensity arc.

Cerium fluoride or cerium oxide is usually used in high intensity electrodes. The carbides themselves are unstable and cannot be used directly. The temperature at the crater of the arc, however, is so great that a chemical reaction takes place between the carbon and the cerium compound which forms cerium carbide just at the core face in the bottom of the crater. Colloidal particles of this carbide make the bright flame in the crater and give a brilliancy of over 500 candlepower per square millimeter. The temperature of this flame is approximately 5,000 degrees C.

The "How" of It

When the flame has overflowed from the crater and comes in contact with the air, the cerium carbide is immediately burned by the oxygen into cerium oxide and carbon dioxide. This is the reason

Fig. 3.—Cross-sectional view of normal high-intensity arc, 150 *amperes*



the high-intensity arc was not thoroughly understood for many years; the source of light is a compound created *only at the instant it is needed in the crater* and destroyed again the instant it leaves the crater.

In the motion-picture field, the high-intensity arc has had a most interesting history. First, in the studios, it entered as a super floodlight of high actinic value. The power of these high-intensity floods was one of the causes of the rapid expansion of motion-picture studios from the small set to the huge sets that were built during the flourishing years of the silent motion pictures, 1922 to 1928. In 1921, one or two of these high-intensity floods was enough to over-illuminate the average set; but within a few years' time the sets grew to such enormous size that banks of fifty to seventy high-intensity arc floods were used on single sets, aggregating as high as 10,000 amperes in high-intensity floods alone.

With the coming of the sound motion-picture, spectacular effects were set aside for the spoken word, and the noise of the arc also interfered with the voice recording. Consequently, the arcs fell into disuse, but turning to the projection end of the industry, we find the "Talkies" had the opposite effect on high-intensity arcs.

High-intensity arcs were first tried in motion-picture projection about 1921. They were needed especially for the newer motion-picture houses which were being built, with seating capacities of 3,000 or over. The motion picture industry was just outgrowing the "movie house" and moving into the motion picture "palace." Fortunately, the high-intensity arc arrived just in time to make possible clear projection in these large houses. It was possible to increase the lumen output of the motion picture projector three times by changing the source of light from the carbon arc to the high-intensity arc, so the latter became well established in all of the larger houses.

When, however, sound motion pictures arrived, there still was further demand for increase of light. This was because the screen had to be made porous in order to let the sound come through it from the loud speakers located behind it, and the porosity which allowed the sound to come through in one direction unfortunately allowed the light to fall through in the other direction, and

this loss of light had to be compensated for by increased illumination from the projector. Consequently, the high-intensity projection lamp has come into widespread use, both in large and medium-size theatres since the arrival of the talking motion picture.

The newest field in which the high-intensity arc has become established is in theatre spotlighting. In this field the old-fashioned carbon arc spotlight held full control because of its simplicity until very recently. The new high-intensity spotlight contains so many novel features and is so flexible in its performance that it is taking the place of the old type of spotlights in many of the better class theatres.

The main difference between this spotlight and the standard spotlight is that, instead of imaging the source of light directly on the stage by a single objective lens, this spotlight images the source of light on an aperture and then reimages the aperture on the stage by means of a second objective lens. In this way, it is possible to regulate the spot of light on the stage by manipulating the size and shape of the aperture. The aperture area, therefore, has an iris shutter which makes it possible to bring down the spot of light on the stage to such a small size that it covers only the head of a performer. Then, immediately, by opening the iris shutter, the spot may be spread to full stage.

In addition to this, there is a pair of rectilinear cut-offs at the aperture which make it possible to form square spots or long slit-like spots. A long horizontal spot may be used, for example, to illuminate the whole width of an orchestra without allowing any stray light to fall either on the audience below or on the stage above. This spotlight also contains a full complement of color filters but, because of the intensity of the beam of light, it has been found necessary to air-cool the gelatin filters. The air-cooling blower is positioned just below the lenses.

[1] The Hall & Connolly Spotlight.

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INTERNATIONAL PROJECTIONIST

DEVELOPMENT AND USE OF THE SOUND MOTION PICTURE

H. M. Wilcox

VICE PRESIDENT, ELECTRICAL RESEARCH PRODUCTS, INC.

From time to time INTERNATIONAL PROJECTIONIST *is asked to supply data relative to the chronological development of the art of sound motion pictures. The accompanying article, a reprint of a paper presented by Mr. Wilcox before the Franklin Institute of the State of Pennsylvania, is a comprehensive and technically correct exposition of the development of this art.*—EDITOR.

EVERY improved facility of communication has had a profound influence on civilization. The printing press, the telegraph, the telephone, the radio have each in turn contributed to the welfare of mankind. The talking motion picture is another useful means of communication, supplementing but not supplanting those already existing. For its emotional effects it appeals to our two most acute and discriminating senses, sight and hearing, and therefore is subject to at least double the hazard of a medium which seeks to satisfy either one individually, as lack of coördination may result in a ridiculous effect. But with these hazards overcome it has far more power to rouse us both emotionally and intellectually.

So far its use has been confined largely to entertainment; but as man lives not by bread alone, its contribution to the happiness of mankind has been not inconsiderable even in this relatively restricted field. . . . This is a new instrument, a mere infant commercially only five years old, and experience must be gained in its application.

Characteristics of Sound

The problems of recording and reproducing are highly technical. They involve the conversion of minute units of energy back and forth, their fixation, their amplification and their final delivery undistorted to one of the most sensitive and discriminating of our senses. Sound waves are converted into electrical energy, thence into mechanical or light energy; then the fixation process, thence back into electrical energy and a final reconversion back into sound. The whole might be considered as a continuous electrical circuit with a delay element, the recording process. To appreciate the problems involved, it is essential to have some understanding of the characteristics of sound and the capacity of the human ear to interpret them.

Sound has its origin in vibrating bodies. The atmosphere exerts a definite uniform pressure on all bodies with which it is in contact. When vibrations have been communicated to the atmosphere they cause rapid fluctuations in this pressure above and below its normal static value. These changes of pressure on the ear result in the sensation which we know as sound.

There are three generally recognized characteristics by which sound is judged by a listener.

Pitch, which is measured by the frequency or number of pulsations per second. The audible range is from about 16 to 16,000 vibrations or cycles per second and is frequently termed the "sound spectrum".

Volume or loudness, which is measured in terms of energy intensity or pressure. Since the ear hears logarithmetically, this is expressed in terms of logarithmetic units called "decibels", one decibel being approximately the smallest change in volume which the ear can detect.

Quality or timbre, which depends upon the presence of overtones of the fundamental frequency, that is, frequencies having two or more times the frequency of the original fundamental note. Timbre is dependent not only on the number of these harmonics or overtones, but also upon the relative intensities with which they occur. Nearly all musical instruments have in them the same series of overtones, but the relative intensities of the individual overtones vary considerably from one instrument to another and it is this that determines the character or personality of the instrument.

Frequency Range

In speech the range of fundamentals is relatively narrow, extending from about 100 to 250 cycles for male speech and about 200 to 500 cycles for female speech. It is interesting to note, however, that practically none of the characteristics of speech by which we recognize one articulate sound from another is particularly influenced by these fundamentals.

The frequencies which are responsible for our ability to understand articulate speech lie among the harmonics of the

(*Please turn to page* 30)

First Publication Anywhere—

Characteristics of All

WESTERN ELECTRIC

Sound Motion Picture Vacuum Tubes

Code No.	Type	Type Cathode	Filament Supply	Purpose	Socket	Height
102D	3-Elem.	Oxide Coated Fil.	D.C.	Tel. Repeater	100L-100R	4 1/2"
102G	3-Elem.	Oxide Coated Fil.	D.C.	Tel. Repeater	100L-100R	4 1/2"
205D	3-Elem.	Oxide Coated Fil.	A.C.-D.C.	General Purpose	100M-115B	4 1/2"
211D	3-Elem.	Oxide Coated Fil.	A.C.-D.C.	General Purpose	112A-118A	7 15/1
211E	3-Elem.	Oxide Coated Fil.	A.C.-D.C.	Audio Amplifier	112A-118A	7 15/1
215A	3-Elem.	Oxide Coated Fil.	D.C.	General Purpose	125B	2 11/1
239A	3-Elem.	Oxide Coated Fil.	D.C.	General Purpose	130B-131A	4"
242A*	3-Elem.	Thor.Tungsten Fil.	A.C.-D.C.	Power Amplifier	112A-118A	7 15/1
247A	3-Elem.	Indirectly Heated	A.C.-D.C.	Amplifier	134A-137A	4 7/8"
252A	3-Elem.	Oxide Coated Fil.	A.C.-D.C.	Amplifier	130B-131A	6 3/4"
262A	3-Elem.	Indirectly Heated	A.C.-D.C.	A.F. Amplifier	130B-131A	5 1/4"
264A	3-Elem.	Oxide Coated Fil.	D.C.	Amplifier	130B-131A	4"
275A	3-Elem.	Oxide Coated Fil.	A.C.-D.C.	Power Amplifier	130B-131A	5 5/8"

*The characteristics given for all power tubes designated by an asterisk are

A Convenient Form for Projection Room Use

Code No.	Type	Type Cathode	Filament Supply	Purpose	Socket	Height
214E	Half-Wave, High Vacuum	Thoriated Tungsten Filament	A.C.	Rectifier	112A-118A	7 7/8"
219D	Half-Wave, High Vacuum	Oxide Coated Fila.	A.C.	Rectifier	D-85700-119A	13 5/
253A	Half-Wave, Mercury Vapor	Oxide Coated Fila.	A.C.	Rectifier	138A-139A	6 13/
258A	Half-Wave, Mercury Vapor	Oxide Coated Fila.	A.C.	Rectifier	138B-139A	8 15/
263A	Double Half-Wave, Argon	Oxide Coated Fila.	A.C.	Rectifier	139A	10 3/
274A	Double Half-Wave, High Vacuum	Oxide Coated Fila.	A.C.	Rectifier	130B	5 5/8

*The characteristics given for all power tubes designated by an Asterisk are based on t

s meter	Normal Filament Current, Amperes	Normal Filament Voltage	Normal Plate Voltage	Normal Grid Voltage	Normal Plate Current Milliamps.	Average Amplification Factor	Average Plate Resistance, Ohms	Average Mutual Conductance, Micromhos	Maximum Plate Dissipation, Watts
/8"	1.00	2.1	130	-1.5	0.65	30.	60,000	500	
/8"	1.00	2.1	130	-1.5	0.65	30.	60,000	500	
/8"	1.60	4.5	350	-20	35.	7.3	3,500	2,080	14
/16"	3.0	10.0	750	-30	65.	12.5	3,200	3,900	65
/16"	3.0	10.0	750	-30	65.	12.5	3,200	3,900	65
1/16"	.25	1.0	60	-3	1.3	5.8	18,000	320	
/32"	.27	1.1	100	-8	2.3	6.2	15,000	410	
/16"	3.2	10.0	1,000	-80	150.	12.5	3,500	3,600	100
5/16"	1.60	2.0	135	-4.5	3.33	14.9	16,000	930	
1/16"	2.0	5.0	450	-60	60.	5.1	1,500	3,400	27
5/16"	.32	10.0	135	-4.5	2.8	15.	16,000	940	
/16"	.30	1.5	100	-8	2.1	6.9	13,000	530	
/16"	1.2	5.0	200	-45	45.	2.9	1,000	2,900	

on their use as Class "B" Amplifiers.

	A.C. Rating		Two Half-Wave or One Double Half-Wave Rectifying With Single Phase A.C. Supply D.C. Rating		
ter	Filament Current Amperes	Filament Voltage	Current Milliamperes	Voltage	
16"	3.2	10.0	150	750	
8"	6.0	14.0	250	1,500	
16"	3.0	2.5	300	1,000	Approx. Anode-Cathode Potential Drop When Conducting 15 Volts Max. Peak Plate Current 0.50 Ampere Max. Peak Inverse Potential 3,500 Volts Safe Operating Ambient Temperature 10-50* C.
/16"	7.0	2.5	800	2,000	Approx. Anode-Cathode Potential Drop When Conducting 15 Volts Max. Peak Plate Current 1.1 Amperes Max. Peak Inverse Potential 6,500 Volts Safe Operating Ambient Temperature 10-50* C.
4"	15.0	2.5	4,000	25	Approx. Anode-Cathode Potential Drop When Conducting 8 Volts Max. Peak Plate Current 6 Amperes Max. Instantaneous Potential Between Anodes 100 Volts
16"	2.0	5.0	150	500	Max. Applied A.C. Voltage, 600 Volts R.M.S. Per Plate

as class "B" Amplifiers.

First Publication Anywhere—

Characteristics of All WESTERN ELECTRIC Sound Motion Picture Vacuum Tubes

Code No.	Type	Type Cathode	Filament Supply	Purpose	Socket	Maximum Overall Dimensions Height	Maximum Overall Dimensions Diameter	Normal Filament Current, Amperes	Normal Filament Voltage	Normal Plate Voltage	Normal Grid Voltage	Normal Plate Current Milliamps.	Average Amplification Factor	Average Plate Resistance, Ohms	Average Mutual Conductance, Micromhos	Maximum Plate Dissipation, Watts
102D	3-Elem.	Oxide Coated Fil.	D.C.	Tel. Repeater	100L-100R	4 1/2"	2 3/8"	1.00	2.1	130	-1.5	0.65	30.	60,000	500	
102G	3-Elem.	Oxide Coated Fil.	D.C.	Tel. Repeater	100L-100R	4 1/2"	2 3/8"	1.00	2.1	130	-1.5	0.65	30.	60,000	500	
205D	3-Elem.	Oxide Coated Fil.	A.C.-D.C.	General Purpose	100M-115B	4 1/2"	2 3/8"	1.60	4.5	350	-20	35.	7.3	3,500	2,080	14
211D	3-Elem.	Oxide Coated Fil.	A.C.-D.C.	General Purpose	112A-118A	7 15/16"	2 1/16"	3.0	10.0	750	-30	65.	12.5	3,200	3,900	65
211E	3-Elem.	Oxide Coated Fil.	A.C.-D.C.	Audio Amplifier	112A-118A	7 15/16"	2 1/16"	3.0	10.0	750	-30	65.	12.5	3,200	3,900	65
215A	3-Elem.	Oxide Coated Fil.	D.C.	General Purpose	125B	2 11/16"	11/16"	.25	1.0	60	-3	1.3	5.8	18,000	320	
239A	3-Elem.	Oxide Coated Fil.	D.C.	General Purpose	130B-131A	4"	1 3/32"	.27	1.1	100	-8	2.3	6.2	15,000	410	
242A*	3-Elem.	Thor.Tungsten Fil.	A.C.-D.C.	Power Amplifier	112A-118A	7 15/16"	2 5/16"	3.2	10.0	1,000	-80	150.	12.5	3,500	3,600	100
247A	3-Elem.	Indirectly Heated	A.C.-D.C.	Amplifier	134A-137A	4 7/8"	1 13/16"	1.60	2.0	135	-4.5	3.33	14.9	16,000	930	
252A	3-Elem.	Oxide Coated Fil.	A.C.-D.C.	Amplifier	130B-131A	6 3/4"	2 11/16"	2.0	5.0	450	-60	60.	5.1	1,500	3,400	27
262A	3-Elem.	Indirectly Heated	A.C.-D.C.	A.F. Amplifier	130B-131A	5 1/4"	1 13/16"	.32	10.0	135	-4.5	2.8	15.	16,000	940	
264A	3-Elem.	Oxide Coated Fil.	D.C.	Amplifier	130B-131A	4"	1 3/16"	.30	1.5	100	-8	2.1	6.9	13,000	530	
275A	3-Elem.	Oxide Coated Fil.	A.C.-D.C.	Power Amplifier	130B-131A	5 5/8"	2 3/16"	1.2	5.0	200	-45	45.	2.9	1,000	2,900	

*The characteristics given for all power tubes designated by an asterisk are based on their use as Class "B" Amplifiers.

A Convenient Form for Projection Room Use

Code No.	Type	Type Cathode	Filament Supply	Purpose	Socket	Maximum Overall Dimensions Height	Maximum Overall Dimensions Diameter	A.C. Rating Filament Current Amperes	A.C. Rating Filament Voltage	Two Half-Wave or One Double Half-Wave Rectifying With Single Phase A.C. Supply D.C. Rating Current Milliamperes	D.C. Rating Voltage		
214E	Half-Wave, High Vacuum	Thoriated Tungsten Filament	A.C.	Rectifier	112A-118A	7 7/8"	2 1/16"	3.2	10.0	150	750		
219D	Half-Wave, High Vacuum	Oxide Coated Fila.	A.C.	Rectifier	D-85700-119A	13 5/8"	3 5/8"	6.0	14.0	250	1,500		
253A	Half-Wave, Mercury Vapor	Oxide Coated Fila.	A.C.	Rectifier	138A-139A	6 13/16"	2 3/16"	3.0	2.5	300	1,000	Approx. Anode-Cathode Potential Drop When Conducting Max. Peak Plate Current Max. Peak Inverse Potential Safe Operating Ambient Temperature	15 Volts 0.50 Ampere 3,500 Volts 10-50° C.
258A	Half-Wave, Mercury Vapor	Oxide Coated Fila.	A.C.	Rectifier	138B-139A	8 15/16"	2 11/16"	7.0	2.5	800	2,000	Approx. Anode-Cathode Potential Drop When Conducting Max. Peak Plate Current Max. Peak Inverse Potential Safe Operating Ambient Temperature	15 Volts 1.1 Amperes 6,500 Volts 10-50° C.
263A	Double Half-Wave, Argon	Oxide Coated Fila.	A.C.	Rectifier	139A	10 3/4"	3 1/4"	15.0	2.5	4,000	25	Approx. Anode-Cathode Potential Drop When Conducting Max. Peak Plate Current Max. Instantaneous Potential Between Anodes	8 Volts 6 Amperes 100 Volts
274A	Double Half-Wave, High Vacuum	Oxide Coated Fila.	A.C.	Rectifier	130B	5 5/8"	2 3/16"	2.0	5.0	150	500	Max. Applied A.C. Voltage, 600 Volts R.M.S. Per Plate	

*The characteristics given for all power tubes designated by an Asterisk are based on their use as class "B" Amplifiers.

UNITS OF MEASUREMENT USED IN SOUND REPRODUCTION

***By* The Onlooker**

IT is doubtful if any group of men, anywhere, ever mastered a force-pressure job of education comparable to that which confronted motion picture projectionists when sound burst on them, a few years ago. In the clamor and confusion of that time projectionists were faced with the necessity of operating a new and intricate machine *first*, and learning about it *afterward*. They learned about it—and meanwhile they kept it functioning. Some day the industry may come to realize the heroic nature of the job they faced, and the importance of their real contribution to the successful introduction of sound.

But even today too many men who have acquired a first-rate working knowledge of their equipment are still reminded of their sensations in 1928 by the mention of a few unusual words. *Dyne* is one; *decibel* another; and then there are *mu* and *amplification factor*, and so on. All of them are words describing equipment and operations with which the projectionist has made himself familiar. There is no good reason why he should not also acquire at least a speaking acquaintance with that handful of syllables.

The dyne, for example, is only a unit of measurement very similar to the term horsepower. The decibel is also a unit of measurement. The decibel, however, is an unusual unit, different from those which most of us non-mathematicians encounter in daily life. Its peculiar nature can perhaps best be appreciated by considering first the dyne, and other, even more commonplace standards. We are all familiar enough with inches, feet and miles.

Common Measuring Units

Those most familiar of all measuring units will perhaps throw some light on the real simplicity of other forms of measurement. The foot, for example. It was once the length of a man's foot, as the dictionary says. Such a standard was too confusing, and the foot became one-third the length of a special yardstick kept under lock and key by government. The mile was once a thousand (mille-thousand), paces. It was standardized as 1,760 yards. In the last century the meter replaced the yard for most scientific purposes. The meter is not the length of a standard stick (although there is a standard meter at Paris), but 1/40,000,000 of the circumference of the earth taken around the poles.

These things are so simple that we take them for granted and talk about them unconsciously; still, in review, they should prove illuminating. The *volt, ampere*, and *ohm* are familiar enough to all projectionists, but the basis of those standards may not be so well known. They were adopted by an international congress of electricians. The exact values are not particularly interesting: the ohm is the resistance offered by a column of mercury of definite length and cross-section, maintained at a definite temperature. The ampere is the amount of current that will do a measured quantity of electro-plating in a specified solution in one second. And the volt, of course, is the potention necessary to drive a current of one ampere through a resistance of one ohm.

Watt, Horsepower, and Dyne

The *watt*, (for direct current), is, as everyone knows, one volt multiplied by one ampere, and is therefore the measure of electrical power. The *horsepower* is the measure of mechanical power. It is energy necessary to lift 33,000 pounds one foot in one minute. The *dyne* is a similar unit—adopted, among other reasons, because the English and the French couldn't agree on how many pounds a horsepower was to lift, and the French standard still differs from the English standard of 33,000.

The dyne is the force which, applied to one gram for one second, will impart to it a velocity of one centimeter a second. It is thus a unit of mechanical force, like the horsepower, but a much smaller unit, and either dynes or watts are customarily employed in connection with the strength of the alternating air pressure developed by a loudspeaker.

The Decibel

The *decibel* (*d.b.*) differs from these simple units of measurement in two important respects. In the first place, it does not describe *quantity*. It describes a ratio—a relationship. Crudely and inaccurately, the decibel might be compared to the percentage column in a list of baseball results. The number of games won and lost are definite numbers. The percentage column indicates the relationship between the number of games won and the number lost. The decibel in one of its uses expresses the ratio between the sound power fed to an amplifier—or a volume control—and the sound power drawn from the same apparatus.

The second difference between the decibel and the other units which have been described here is that those others are based on physical and material facts—the length of a yardstick or the resistance of a column of mercury of definite size. The decibel is based upon a *human* characteristic, and it is used in order that sound systems may be designed and operated in accordance with the peculiarities of the human ear.

If a waiter is holding a tray weighing one ounce, and someone secretly adds an ounce to the tray, the waiter will feel the difference at once. If the tray weighed ten pounds the waiter would not feel the addition of a single ounce. The ear reacts in the same way to differences in sound volume, and the eye to differences in brightness of light. Human

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Projection

The placing of an image on the screen is the last phase of this business, yet, in fact, it is *the only thing that counts.* I do not care what technical theories are involved, the only thing that interests the exhibitor is what he shows to his patrons—the finished job as it looks on his screen. Projection is the vital link between production and exhibition, and unless the standard of projection is such as to get out of the picture everything that there is in it, we might just as well close up shop and go out of business.

M. A. LIGHTMAN,
President, Motion Picture
Theatre Owners of America.

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senses do not measure absolute quantities. They measure only a *ratio* between the quantities of anything present *before* and *after* some change.

The reaction of human senses, including the ear, has long been known, and happens to be of what mathematicians call a logarithmic nature. In the following table the small numbers in the right-hand column are the *logarithms* of the larger numbers shown in the left-hand column;

10	1
100	2
1,000	3
10,000	4
100,000	5
1,000,000	6

The nature of logarithms in mathematics are no concern of this discussion, but the fact that a definite relationship exists between these two sets of figures can be seen by looking at them. Ten taken once is ten; ten taken twice (ten x ten) is a hundred; ten taken three times (ten x ten x ten) is a thousand, and so on.

Now, if the figures on the left are taken to indicate increases in sound volume, as measured in watts or dynes, the figures on the right will indicate the increase in sound volume *as the ear hears it*. This table shows that a million-fold amplification is necessary for the ear to hear one sound as six times as loud as another sound.

The decibel is 10 times the logarithm of the ratio between the two sounds;

INCREASE IN SOUND VOLUME AS MEASURED IN WATTS OR DYNES	INCREASE IN SOUND VOLUME AS HEARD BY EAR, MEASURED IN DECIBELS
10	10
100	20
1,000	30
10,000	40
100,000	50
1,000,000	60

Many sound systems have a gain of more than 60 decibels, or an absolute amplification of more than 1,000,000.

It can be seen from the above that amplifiers, volume controls, attenuators and other apparatus designed, in the last analysis, to influence human beings are most conveniently designed and calibrated according to their effect upon the ear, and *not* according to changes in absolute power, which to the ear may be meaningless.

For example, a change in sound volume equal to three decibels is the smallest change in volume the average person can distinguish, and volume controls in the average sound system are generally arranged to change the volume by three decibels at each step. A *constant change in decibels* at each step does not, as can be seen, mean a *constant change in wattage* at each step. The difference in wattage will vary according to the value of the decibel at that point in the volume, and the relation between change in decibels and change in wattage will be a logarithmic relationship.

Uses of the Decibel

The decibel has two uses. It measures the ratio of change in the volume of sound, as such change is heard by human beings. It will also measure the ratio between any given sound and the lowest volume average person can hear. In the first case, the d.b measures the gain or the loss introduced by an amplifier or a volume control. In the second case, the d.b. measures the "level"—as heard by the ear—above the minimum of audibility.

The lowest audible sound is taken, on an average, as equal to .006 watts. An amplifier has a sound output of so-and-so-many watts—depending on the size of the amplifier. Expressed in terms of human hearing, it has an "output level" of so-and-so-many decibels. The level expresses the ratio between the maximum undistorted output of the amplifier and .006 watts.

It does not express the "gain." The input power to the amplifier may be much below .006 watts, in which case the gain—if the amplifier is used at full power—will be greater than the level. Thus, an amplifier having a *level* of 40 d.b. may have a *gain* of 60 d.b. This will mean that the sound power at the input of the amplifier is -20 d.b. or 20 decibels lower than .006 watts, and the action of the amplifier creates a *gain* of 60 d.b. by means of which the level is raised to plus 40.

These two uses of the decibel sometimes confuse the projectionist, yet their distinction is not obscure. In both cases d.b. measures the ratio of changes in sound volume. In both cases it measures that ratio as the ear hears it. In the case of gain (or loss), it measures the ratio of change above or below the previously existing volume. In the case of the level, it measures the ratio between the existing sound and an arbitrary level of .006 watts.

Familiarity with the ratings in decibels of projection room sound equipment will help clarify this distinction for any projectionist.

Grid Voltage and Plate Voltage—The Mu

Most of the other terms not always known to projectionists before the days of sound relate to the ratings of tubes. The tube is a piece of apparatus having complicated functions, which must be measured if the tube is to be standardized. Some of these measurements involve ratios between the input and the output action of the tube. Tubes, however, *are not* rated in decibels.

The heated filament emits electrons, by means of which current flows across the vacuum of the tube. This is the plate circuit. In the case of a rectifier tube the only question of importance is whether or not the electronic emission is large enough to enable the tube to pass the full quantity of current for which it is rated. This is easily determined by inserting an ammeter or a milliammeter in the plate circuit and measuring the current flow. The same measurement is often applied to amplifying tubes, but there is not, in itself, a sufficient indication of the tube's performance. What needs to be measured in an amplifying tube is the *amplification*.

It is known that a small change in the voltage placed on the grid of an amplify-

DOING THE JOB!

PRODUCER-DISTRIBUTOR house organs are filled with pretty sayings about theatre operation in general and, occasionally, about projection in particular. The following exhortation to theatre managers by a theatre circuit executive may be tied up with the paragraph appended thereto:

> If you want a job well done, do it yourself!
>
> Swivel-chair theatre management has no place in . . . . You can't successfully run your theatre if you're not at the scene of operation. The wants of your audience must be met. Sound must be perfect. Ventilation must be correct. Service must be of the best. The mixing of all these ingredients which go to make up a theatregoer's pleasure must be carefully supervised. If you're in your office when you should be on the floor of the theatre, then your patrons are not getting an even break.
>
> It's an old saying that you can't run a ball team from the locker room. The same thing applies to a theatre. It can't be done!

Great stuff! But it doesn't apply to competent supervision of projection, which admittedly is the key to efficient theatre operation, for this same circuit only recently found it possible to dispense with sixteen (16—count 'em—16) district supervisors of projection, their work to be handled in future by a "swivel-chair" projection executive in New York.

ing tube will cause a larger change in the voltage at the plate of the tube. The ratio between these two changes is the *mu*, or "amplification factor" of the tube. Tube testers—not often found in projection rooms—measure both changes of voltage simultaneously. Sometimes their meters are so calibrated as to give a direct reading in *mus*.

The mu, or amplification factor, however, is not the only or the final test of a tube's behavior. The object of securing a change in plate voltage is to take advantage of the necessary change in plate current which must accompany it. It is current, after all, and not voltage, that operates the loudspeaker. Therefore, the final unit in tube testing is the *mho*, which is "ohm" spelled backwards. A tube is the reverse of a resistance, which causes *loss of power;* the action of the tube results in *gain in power.* That gain —the mutual conductance—is measured in micro-mhos, and it is the relationship between changes in *grid voltage* and the corresponding changes in *plate current* which follow if the tube is functioning as it should. Some tube testers are equipped with meters that will read mutual conductance as well as amplification factor, directly, without need of any calculation.

A list of the terms mentioned in this article may help fix their meaning in the minds of projectionists:

DYNE—A unit of mechanical power, similar to but smaller than horsepower.

DECIBEL—A unit measuring the ratio between two sounds of different volume, as the ear hears them. Used in reference to "gain," it measures the relationship between the input and the output power of an amplifier, a volume control, or/and a sound system. Used in reference to "level," it measures the ratio between any given sound (or maximum capacity of an amplifier), and a "minimum of audibility" equal to .006 watts.

PLATE CURRENT.—The current, in amperes or milliampers, which flows across the vacuum of a rectifier or an amplifier tube.

MU—The relationship between a change in grid voltage and the change in plate voltage that follows.

AMPLIFICATION FACTOR—Same as MU.

MHO—The relationship between a change in grid voltage and the change in plate *current* that follows. "Ohm" spelled backwards. The practical unit is the *micro-mho.*

MUTUAL CONDUCTANCE — Same as MHO.

BARROWS HOME FROM EUROPE

SAFELY returned from a European jaunt, Thad Barrows moans: "Was I blue". He must have been looking at some French projection. Color fringe is quite common in European projections.

A COMMON SENSE ATTITUDE ON WORK, WAGES AND SAFETY

George A. Yager

BUSINESS MANAGER, L. U. 250. SALT LAKE CITY, UTAH

AS chairman of the Safety Committee of the Projection Advisory Council, I read with much interest the article by M. D. O'Brien in the July issue of INTERNATIONAL PROJECTIONIST. This excellent article called the attention of the projectionist to the many faults existent in projection rooms, some of which may be charged directly to the projectionist, and others which are chargeable to the management.

I agree with Brother O'Brien in all his remarks, but believe the proper approach to a safety problem is from a more personal standpoint than that of audience safety. The projectionist is a father as well as a husband in the majority of cases, and therefore, naturally approaches the safety angle from the viewpoint of a man with a responsibility to his family.

This being the season of the year in which wage scales are negotiated, I believe it would be very pertinent to comment on the relationship between safety and wages.

Wages vs. Conditions

It would be interesting to tabulate at the end of this wage negotiating period, the number of local unions that have sacrificed the personal safety of their membership by subordinating working conditions to the almighty dollar. Not that the writer, in any way, would minimize the need of projectionists generally for a higher wage, but because I would not, if faced with the necessity for either a cut in wages or a cut in working conditions, consent to the sacrifice of conditions for the purpose of maintaining wages.

Wages will always fluctuate with economic conditions until economic conditions are properly regulated by industrial and social planning, but it should be obvious that working conditions have no relationship to economic conditions.

For instance, if two-men crews are necessary in projection rooms (and in the opinion of the writer, they are, for the safety of the projectionist himself if for no other reason), it should be obvious that they are just as necessary in times of depression as they are in a period of prosperity, assuming no change in projection room conditions. The fire hazard is certainly not changed by economic conditions.

Local unions who so far forget the proper functions of a labor organization that, in order to maintain an artificially high wage scale, they are willing, for instance, to sacrifice two-men crews to maintain wages, certainly have no regard for the welfare and safety of their membership.

One Who Paid the Price

The writer was a friend of the projectionist referred to in the "Testimony of a Theatre Employee of Provo, Utah", reprinted from a previous article of mine along with the article of Brother O'Brien's, and I feel sure that if this brother could speak today, he would advocate that all local unions maintain working conditions ahead of wage scales. Any conscientious projectionist will agree that when a projector is in operation, the projectionist should be constantly at the side of the projector in operation. That this is an impossibility with one-man crews is at once obvious. With two-men crews, it is not only possible but should be made by the local unions throughout the country mandatory on the part of the membership.

The writer has personally seen projectionists who, once their projector was well under way, would spend the ensuing six or eight minutes in wandering aimlessly about the projection room, their backs to the projector, their minds off their work, and as useless in case of fire as it would be possible for men to be and still be in the projection room. This condition will, if known to the management, naturally convince them there is no necessity for two-men crews. The simple truth of the matter is this: the management, as well as the projectionist, completely overlooks the highly necessary element of safety. The management may purposely overlook this element, but there certainly can be no excuse for a projectionist so doing.

Definite Plan of Action

Many state industrial commissions and departments of labor have the authority to make any ruling they may deem necessary for the health and protection of the employees of any factory, shop or business within the confines of their respective states. If projectionist locals are interested in the safety factor, they would do well to ascertain the power of the commission in the matter and see that regulations are made which makes mandatory the maintenance of two-men crews.

Projectionists should also see that the recommendations made by the service engineer are properly carried out by the management, as there has developed, since the depression, an

increasing tendencv on the part of theatre managers to postpone the purchase of parts as well as any additional servicing which has for its purpose the maintenance of equipment.

Projectionist locals should specifically state in their contracts that they will not, under any circumstances, be responsible for fire damage or other physical damage to film in projection rooms where the service engineer has indicated on his report that repairs or additional service are necessary, when the management in question has refused to make proper replacements or authorize necessary overtime for proper service. In connection with servicing, it should also be noted that in no instance, with the exception of a serious emergency, should servicing be done while the theatre is in operation, and should further specify that in the event servicing is done while the theatre is in operation, neither the local union nor the crew on duty shall be held responsible for screen results or any additional hazard which may arise through the existence of additional duties for the projectionist due to such service.

In the final analysis, health and safety may well be summed up to mean a rigid adherence to common sense regulations which are within the power of any local union to promote. Health may be summed up as meaning properly ventilated projection rooms kept in a clean condition, and safety as a common sense application of simple rules well known to all projectionist locals but at times, forgotten by them in their mad scramble for the almighty dollar.

[NOTE: INTERNATIONAL PROJECTIONIST is fully in agreement with the content of Mr. Yager's article. A definite plan of action, as contrasted with the policy of merely "beefing" and remaining inactive has long been advocated by this publication.—EDITOR.]

GERMAN REEL STANDARD

According to a report from Trade Commissioner George R. Canty, at Berlin, negotiations within the German film industry propose a standardization of film reels at a length of either 900 or 1,000 meters (3,280 feet).

FRENCH PROJECTIONIST 'EXAM'

Examinations in Paris to obtain a professional certificate for the projection of sound motion pictures took place recently at the Technical School of Photography and Cinematography. 26 candidates took the examination. Examinations covered the following subjects:

1—general electricity; 2—general technical electricity; 3—radio technics; 4—acoustics; 5—sound cinematography (theoretical part); and 6—sound cinematography (practical part).

SOUND PROJECTION 'SCHOOLS' OPEN NEW OFFENSIVE

James J. Finn

Opening of Fall and Winter seasons is the signal for renewed activity by promotors of projection and sound "schools" with varying curricula and rates. Suggest Local Union legislation barring members' participation.

UNDAUNTED by the fate that befell certain promoters of sound picture and projection "schools", as exemplified by the present tenure of F. A. Jewell in Atlanta Penitentiary, numerous promoters have reentered the projection field and are again zealously furthering the cause of the resident and correspondence projection "school".

INTERNATIONAL PROJECTIONIST has always been, is now and will continue to be opposed to any resident or correspondence projection school. The reasons for this opposition, as repeatedly set forth in these columns, include the following: (1) the projection and sound field are greatly overcrowded at the moment, despite claims to the contrary by sound school promoters. Incidentally, this excess of manpower is a direct cause of many of the present unsettled labor situations. (2) The record proves that a majority of such enterprises are merely get-rich-quick schemes and seldom, if ever, afford the "student" any benefit. (3) Students "graduated" by such institutions cannot possibly have acquired the knowledge necessary for safe operation of a modern projection room, which statement is borne out by the records of such "operators" during the past two years.

First, let us consider the organization known as the California Operators' Training Association. On this page is reproduced a circular which sets forth in detail the virtues of this Association.

The statements made in this circular are untrue. The demand for "motion picture operators" was *not* increased approximately "100% to 300%" during 1931. As a matter of fact, statistics show that the demand for "motion picture operators" actually *decreased* during 1931. Television as a commercial possibility within the next year is the bunk—and this is 1932, not 1931. Few, if any, projectionists are receiving $125 a week, even with ample overtime. No projectionist of our acquaintance has a job which requires his presence "approximately 4 to 5 hours per shift each day."

Form of Agreement

We come now to the agreement signed by applicants for training by the California Operators' Training Association. Here it is:

Agreement
CALIFORNIA OPERATORS' TRAINING ASSN.
Training men to operate
Western Electric Sound Equipment
California Operators' Training Association,
103 North Rowan Avenue,
Los Angeles, California.
Gentlemen:

Please enroll me for your complete training in Sound Motion Picture Operating on the following terms and conditions:

YOU AGREE to furnish your loose leaf lesson

A NEW OPPORTUNITY
is offered in the
Motion Picture Industry
for
Sound Projection Engineers on
Western Electric and R. C. A. Sound Systems

New Operators must be trained immediately for new Theatres, Steamships, De Luxe Trains, Industrial, Commercial and Educational purposes, using Western Electric and R. C. A. Photophone Sound Equipment

The **only** new field in the country that is not over crowded.

During the year 1931, the demand for Motion Picture Operators was increased approximately 200% to 300%.

SOUND VERSUS SILENT PICTURES

Where the silent pictures employed **one** operator to a shift, sound pictures are using **two** men and in some cases **three**.

THE NEW MOTION PICTURE ERA

The coming advent of the miniature neighborhood theaters, the new Trans-Lux inventions, together with Television, forecasts many new opportunities for those learning Motion Picture Operating.

The Motion Picture Industry is the second largest in the world. Startling new improvements indicate it is **still in its infancy**.

Motion Picture Operators' salaries range from $50 to $125 a week. The working schedule is approximately 4 to 5 hours per shift each day.

Be assured of 52 weeks of steady employment each year.

COMPARE YOUR TRADE with that of the Motion Picture Operators.

(Now read on) OVER

DO YOU KNOW ?

—Of any profession that you could learn in three to six months that would pay the same salary and have the same working conditions and short hours?

—Any other profession that pays from $50 to $125 a week, working only 4 to 5 hours, leaving all the rest of the day for your pleasure and the companionship of your family?

—Of any other trade that you can learn that you can start right in earning $50 to $125 a week and have complete charge of the projection room without having to first serve two or three years as an apprentice as you do in other trades?

. . . AND FINALLY—

If you are sick and tired of the uncertainty of work and are not getting ahead, WHY NOT INVESTIGATE THIS TRADE?

MANY will be called. FEW will be prepared to answer.

Why not take advantage of the new era being created by Western Electric and R.C.A. Photophone?

Just sign the attached coupon and mail it TODAY or phone the registrar in your own city.

California Operators Training Association
103 N. Rowan Ave.
LOS ANGELES, CALIF.

literature by mail for your complete training in Sound Motion Picture Machine Operating, the same to include

Elementary Electricity
Practical Electricity
Mechanics of Projection
Sound Amplification
Western Electric and R.C.A. Instructions
Installation and Trouble Shooting on Sound Equipment
Sound Projection Engineering
Theory of Studio Sound Recording
Sound and Projection Optical System
Television
High and Low Intensity Arc Lamps

YOU AGREE to give me your fifteen day course of practical training on WESTERN ELECTRIC SOUND EQUIPMENT at your headquarters in Los Angeles, upon completion of mail instruction and when the total amount of $165.00 is paid in full; the same also to include ROOM and BOARD FREE during the fifteen day period of such course.

YOU FURTHER AGREE that I may have use of your FREE EMPLOYMENT SERVICE after course is completed, also that I will be enrolled as a life member of the C. O. T. A. without further cost to me.

I AGREE to pay you a total sum of ONE HUNDRED AND SIXTY-FIVE DOLLARS ($165.00) on the following plan:

$............ down on signing agreement.

$............ C. O. D. on receipt of Text Literature and Lesson Binder.

$5.00 per week thereafter until the total amount of $165.00 is paid in full.

10 per cent Cash Discount will be allowed if full amount is paid in advance.

This contract is made in duplicate and contains the terms and conditions of the agreement between the parties and cannot be changed without the mutual written consent of both parties. This contract is not binding on the California Operators' Training Association until signed by its General Manager.

Enrolled By:

....
association representative Student's signature

Date.........., 193..

....
Parent's signature (required only when student is a minor.)

....
Accepted by General Manager of California Operators' Training Association

PROMISSORY NOTE

$..................... ...., 19...

In installments of $.......... a week, I agree to pay to California Operators' Training Association or order, at 103 North Rowan Ave., the sum of $.......... with interest at 7 per cent after maturity.

Should default be made in the payment of any installment, then the whole sum of principal shall become immediately due and payable at the option of the holder of this note. The undersigned hereby agrees and promises to pay all costs of collection including a reasonable attorney's fees which may be incurred in the collection of this note or any portion thereof. The principal and interest herein referred to is payable in gold coin of the United States of the present standard. The makers, sureties, guarantors and endorsers of this note hereby waive diligence, protest, demand and notice of every kind. Should this note be signed by more than one person, firm or corporation, all of the obligations herein contained shall be considered joint and several obligations of each signer hereof.

....
Street Address

....
City State

Now hoves into view what might be referred to slangily as the "pay-off" a letter from one of the "students", one of the shorn lambs, to a friend. This letter states, in part:

Dear ......:

. . . The school so far has failed to help me any. Steele gave me a membership card in the Associated Projectionists of California—just to get me out of town. He said he gave it to me so they could use me as reference when they got some prospective students. They would tell the would-be operator to write me for my opinion of the school, then I would write a fancy answer, and if the nut signed up, then the school would send me $5.00 (five dollars). Five dollars for one letter sounds easy, but so far I have written *NO* letters. I haven't even heard from the school.

They never gave me any contract blanks, etc. I guess they figured the blanks would only be wasted anyway (which would be very good figuring). All I got out of that school was a lot of expense, a chance to see a little of "SUNNY" California, a change of climate, a darned poor education, *and did I get hooked?* Oh! yes, I almost forgot, I got no membership card. (So far they haven't tried to collect any membership dues, which is odd for them.)

Omitting the dizzy school, I sure like to think about the trip . . . . Right at present I am employed by .... in the .... here. Right after I got home, the manager .... caught the chief of service and the doorman keeping tickets and taking them out and selling them. The .... assistant manager wanted to know if I would like the job of doorman, so now I am head doorman for the .... (and still looking for a good job.) Not bad, they fired me once, then called me up and asked me to come back. That's almost as goofy as the California Operators' Training Association.

If I had some money, I would take a vacation to ease my weary mind, but I gave all my dough to Hamilton Steele, to California, and a couple of railways. . . . Hope you have better luck getting a real job then does

Your "old" friend,
(Signed) ....

P. S. Sorry I didn't answer your letter sooner, but for some reason or other, when I work for .... it seems like all I do is work, go to bed, get up, and go to work with darned little time to eat. . . .

Well, the poor boy seems to have succeeded in landing a job as head doorman, which may or may not be a boost for his "operator training". The original of the foregoing letter is on file at the office of the present writer.

We come now to a recent announcement by the receivers for the Electrical Sound Institute, Inc., of Easton, Penna., a summary of the activities of which, together with notice of the trial and sentence of its head, one Fred A. Jewell, was published in the May issue of INTERNATIONAL PROJECTIONIST. The announcement, in part, reads:

IN RECEIVERSHIP:

ELECTRICAL SOUND INSTITUTE, INC.
UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF PENNSYLVANIA

STATEMENT

On June 20, 1932, Fred A. Jewell was sentenced by the United States District Court for the Southern District of New York to serve three years in the United States Penitentiary at Atlanta, Georgia—having been convicted under an indictment charging him and others with unlawfully using the United States mails in a scheme to defraud and to obtain money and property by means of false and fraudulent pretenses.

All previously existing agreements between Electrical Sound Institute, Inc., and Fred A. Jewell and between Electrical Sound Institute, Inc., and National Sound Service Bureau, Inc., have been terminated as of this date. No agreement has existed between Electrical Sound Institute, Inc., and Photo Electric Research Laboratory Corporation since February 13, 1932.

Henceforth the Institute will offer three courses of training as follows:

Sound Projection and Electro-Acoustical Engineering
Photo-Electric Engraving
Short-Wave Radio and Television

. . . Students who have received written promises of the kind mentioned above are entitled under the contract signed by them to two weeks' practical training and are hereby notified that they may elect to avail themselves of such training in either Sound Projection and Electro-Acoustical Engineering or in Photo-Electric Engraving. If the student elects to take his practical training in photo-electric engraving such practical training will include practical instruction on the Howey Photo-Electric Engraving Machine. Dates for such practical instruction must be arranged in advance with the undersigned as a large number of students cannot be accommodated at one time.

The undersigned Receivers will continue—in accordance with the instructions which they have received from the United States District Court—to carry out the contractual obligations of Electrical Sound Institute, Inc., to the best of the Receivers' ability and the Receivers believe—and have reason to believe—that the course of training, and especially the practical training, which the students will now receive—will be of a better grade and will give the student information concerning a much better and more practical photo-electric engraving machine than would have been the case had the original plans of the Institute not been altered.

FRANK A. LIEBERMAN
S. RAYMOND DOBBS
Receivers in Equity.

EASTON, PENNA.
JUNE 20, 1932

The latest sound school promotion venture to come to the attention of this publication is explained through the medium of the appended description supplied by a potential "student":

There is a man by the name of Mr. Grace who claims he represents the DeForest Training, going through Florida and the Southern States at the present time selling same for $50 down payment and $90 balance when the course is completed and position is secured for the students qualifying. I know of a couple boys here who have paid the fifty and are still studying, but it looks like a racket to me. I wish you would get in touch with the DeForest people and find out if they are sponsoring the DeForest-National School of Visual Education, 537 S. Dearborn St., Chicago, Illinois.

After the home study course is completed they state they will send you to the DeVry factory in Chicago, for four to six weeks' training to finish the course and at this time will pay a small salary; and after this course is completed, they will send you on the road as an assistant to the sound engineer, and as soon as the engineer recommends you for a territory, you will be sent out on your own to service sound equipment, etc.

I thought I might take this course, but I don't want to put out $50 on a wildcat scheme.

P. S.: Have Western Electric or RCA Photophone such a course?

The answer to the last question is "No". Regarding the other matters discussed in this letter, the facts at hand are that two letters requesting information addressed to the National School of Visual Education at 537 South Dearborn

Street, Chicago, failed to elicit a response, and as far as the DeForest affiliation is concerned, the following letter is self-explanatory:

DEFOREST RADIO COMPANY
Passaic, New Jersey

Dear Mr. Finn:

In reply to your recent inquiry, I wish to state that we do not know any Mr. Grace, and the DeForest Radio Co. is in no way connected with the DeForest Training-National School of Visual Education, 537 So. Dearborn Street, Chicago, Illinois.

We have had a number of complaints throughout the country on propositions similar to this, and in tracing them down, usually the man who paid his money lost out. Of course, you understand I am not stating that I know anything about this particular company, but I again want to state that we have nothing to do with any of these so-called schools in any way whatsoever.

W. J. BARKLEY,
Vice-President,
DeForest Radio Co.

The salient feature of this sound projection school situation is, as the present writer views it, not whether a particular school be good, bad or indifferent but that it is unnecessary. The projectionist craft already is badly overcrowded, and even within the ranks of organized labor there is hardly enough work to go around. The demand for motion picture projectionists has been steadily decreasing, instead of increasing, and it is likely that this status will prevail for some time to come.

INTERNATIONAL PROJECTIONIST gladly offers its facilities for investigation of any of these so-called "projection schools", and it urges that any such promotional venture be brought to its attention. At the same time, the best protection will be afforded local union members by an alert leadership in being constantly on the watch for such activities.

Local union meetings provide the best means of giving the facts relative to such schools the widest possible publicity, and it is to be hoped that all local officers will bring to the attention of their members at the earliest possible moment the facts as outlined in this article. Several locals have passed legislation barring participation by their members in any similar enterprise, and it would seem that the spread of such legislation would provide an effective means for protecting the various local memberships.

Projection Problems As Seen By The Theatre Owner-Manager

Another contribution to the symposium sponsored by the S.M.P.E. under the general heading "The Film Problems of Theatre Operation" is the accompanying abstracted article by Charles E. Lewis, who writes not only with facility but with authority, the result of many years' experience as a theatre operator and practical showman.—EDITOR.

NOT enough emphasis has been placed upon the equipment and furnishings of the theatre. The manager has been, in many cases, oversold on show-merchandising and undersold on maintaining his theater in perfect condition.

In the sound equipment we have an intricate and costly network of wires, panel boards, exciter lamps, amplifiers, horns, *etc.*, all necessary for properly reproducing sound from film or disk. Most of the houses, according to surveys made by various trade bodies, are equipped with apparatus made by either the Western Electric Co., or RCA Photophone, Inc. These companies maintain service men who make regular inspections and tests in the field, in addition to recommendations of necessary changes, replacements, and repairs.

Exhibitor Ignorance

What, if anything, does the theatre owner know of the technicalities of his equipment? Little or nothing at all. Certainly he knows that the exciter lamps and photoelectric cells require replacement, because he has to pay the bills for them at frequent intervals. Certainly he knows that the fader must be set according to the sound and changing conditions in the auditorium. Of course, he knows that the batteries (if he has them), must be recharged and kept in good condition.

But what does he know about "bellows-assemblies," or "condensers," or the thousand and one other technically-named parts which he is told must be replaced from time to time and for which he must pay as frequently.

Through ignorance alone, and no other cause, many fine theatres are today operating with projection room equipment urgently in need of attention. Dependence is placed almost entirely upon the projectionists, many of whom are conscientious and capable; but unfortunately there are also many who are hardly better than ordinary "operators." The latter do not realize the importance of calling their employers' attention to little defects while they are yet little, thus avoiding costly repairs and breakdowns later.

The care and overhauling of the mechanism is another matter with which the theater operator should be familiar, so that he would not have to depend entirely upon the projectionist. Many projectionists suffer from the delusion that if they keep their machines running without burdening the theater owner with minor maintenance charges, they are regarded as more efficient than the projectionists who insist upon keeping their equipment in first-class condition at all times.

Projectionist Cooperation

It is the theater owner's or manager's duty to check his equipment with the projectionists, and to make certain that the mechanism is kept in good order and is overhauled at frequent intervals. There is no question but that they would be quite willing to do this, were they convinced that such routine expenditures would turn out to be savings in the end.

Now the question of caring for film: thousands of feet of film entering the theater each week must stand the grind until the engagement is over, and then must be shipped back to the exchanges whence it will again be shipped to other exhibitors.

What, if any, thought is given by the exhibitor to the care given the film while in his possession? Very little. In the dim and distant past the exhibitor bought a pair of rewinders, a few film magazines, and a bottle of cement, thus completely discharging himself of his duties. As he rarely hears further about it, he never quite realizes that the reason why he is receiving prints that are in bad condition is that other exhibitors like himself are indifferent to the care of film, and so abuse it that it becomes hardly fit for further use and a cause of aggravation and worry to the next exhibitor.

If the mutilation of film caused by faulty projectors and dilapidated rewinders were stopped, the print thereby being given a fair chance of accomplishing its natural life, ordinary wear and tear excepted, a saving amounting to thousands of dollars would result. Savings would be achieved by the distributor and exhibitor alike, in avoiding terrific losses due to fires, not to mention the panic hazard, *etc.*, all entirely due to such negligence; and the reproduction of sound, too, would immediately improve, due to the better care given to the sound track.

Screen Problems

As to sound screens, thousands of theater owners would like to know just where they stand in this matter. Many of the sound screens installed during the mad rush for sound equipment proved entirely unsatisfactory as to length of service, especially as compared with the screens used for silent projection.

As another point in this connection, many exhibitors purchased sound screens under the impression that, like the silent screens, they could be recoated, refinished, or cleaned by some process that would add to their years of service. Most of the exhibitors now find that when the

(Please turn to page 33)

NEWS and VIEWS

A collection of random thoughts, and some not so random; fact, fancy and opinion pertaining to the projectionist and projection matters. The free-for-all forum.

I. A. Investigates Charges Against Sam Kaplan

THE full General Executive Board of the International Alliance has just concluded a series of hearings which ran for three weeks on charges of maladministration against Sam Kaplan, President of Local Union 306 of New York City. The charges were looked into at the instigation of the American Federation of Labor.

The sessions of the Board were of an executive nature, and no official statements anent the meetings were forthcoming. The information contained in this article, while not "official," was obtained by INTERNATIONAL PROJECTIONIST from sources believed to be reliable and is presented to its readers on that basis.

A. F. of L. Interested

The A. F. of L. originally interested itself in the affairs of Local Union 306 as a result of a vigorous campaign conducted by the *New York World-Telegram* (Scripps-Howard unit), against the administration of Sam Kaplan, President of L. U. 306. This newspaper charged, among other things, that (1) Kaplan ran the Local in "high-handed" fashion and employed "strong-arm" tactics in suppressing the "opposition" members; (2) Kaplan was the owner of a non-union projector manufacturing shop, the products of which were widely distributed among New York union-manned theatres. (These same charges were stressed in literature which was distributed among delegates to the I.A. Convention in Columbus, Ohio, but the matter did not come before the Convention.)

The newspaper also charged that (3) Kaplan was administering the affairs of the local for the benefit of himself and his friends, to the detriment of the general membership, and (4) it pointed to the salaries and "gifts" paid by the Local to Kaplan and a string of organizers. The charge that Kaplan was drawing $21,800 a year as President and Chief Organizer of Local 306, plus "gifts," was never denied.

Charge Political Alliance

The *World-Telegram* also cited (5) the fleet of sound trucks, the cost of assembly and operation of which was borne by L.U. 306 members, with the trucks being placed at the disposal of the Democratic State Committee in the New York State campaign of 1930. These sound trucks are estimated to have cost between $60,000 and $80,000.

The newspaper also stated that dues, assessments and other charges levied against members of L.U. 306 approximated 20 per cent of their total earnings during a year. This rate of payment, said the newspaper, was in sharp contrast to the rate fixed by other units of the I.A.

Apparently concerned by this and other attacks against units of the A. F. of L., President William Green ordered a special investigator for the Federation into New York to sift the charges. The results of this investigation were in the hands of President Green during the recent meeting of the A. F. of L. Council held in Atlantic City, at which President Elliott of the I.A. was asked to appear and explain the charges against Kaplan.

The public press reported that the I.A. head assured President Green that he would press an investigation into the affairs of Local 306 and report back to him at the earliest possible moment.

75 *Houses Switch*

The decision to call the General Executive Board of the I.A. into session was hastened by the occurrences of September 1 on which date more than 75 theatres in New York City terminated the employment of Local Union 306 men and replaced them with members of the so-called "dual union", the Empire State Operators Union. Several days later the latter organization announced that it had more than 300 theatres in New York City under contract, as contrasted with a reported total of 247 houses for Local 306 of the I.A.

Summoned by wire, the I.A. Board members plunged into a series of conferences in special quarters at the Astor Hotel in New York City. It is understood that President Kaplan made several appearances before the Board and discussed in detail the charges which had been made against his administration. Among the charges discussed was that of the so-called "opposition" membership to the effect that no financial statement of the Local Union had been read to the membership at a regular meeting since the year 1926.

Further, the so-called "opposition" charged, the need for a great number of organizers was not apparent, since practically no organization work had been done in the past five years. A denial of the charge that permit men were permitted to work while card men sat idle on the bench in L.U. 306 quarters brought indignant response from the opposing forces which took the form of submission of records showing the meager amount of work done by certain card men over a period of a year.

The charge that Kaplan's retail business with motion picture theatres on projector parts and other accessories was interfering with the proper conduct of the Local's business is reported to have been looked into by the Board. Kaplan is understood to have denied engaging in "retail" trade; but the group opposing him state that they filed with the Board charge slips proving the existence of such business intercourse between Kaplan and the theatres.

The opposition members admit that a careful audit of the books of Local Union 306 was ordered by the Board, but they assert that the results of this audit have not been made known to them. The Board also gave some attention to the charge that no remarks in opposition to Kaplan could be made on the floor of the Local meetings for fear that the speaker would be subjected to physical violence at the hands of a "strong-arm" gang allegedly maintained by Kaplan.

Labor Conditions Prime Concern

It is believed that the Board was primarily interested in the present unsettled labor conditions existing in New York City, and that the charges against President Kaplan personally were regarded as matters of secondary importance. Kaplan is reported to have assured the Board that by October 14 next he would have regained the majority of houses now using the services of Empire State members. The contracts of the latter organization with the theatres are understood to have been written for an initial six-week period, to terminate on October 14.

General-Secretary Fred J. Dempsey was a guest of Local Union 306 at a regular meeting and is reported to have asked that any member having any grievance to report should appear before the Board. The Board subsequently heard these grievances.

All members of the I.A. Executive Board returned to their home cities on

Advertisement of so-called dual union which appeared in a recent issue of "Motion Picture Herald"

EXHIBITORS!!! ATTENTION!!!

The EMPIRE STATE MOTION PICTURE OPERATORS UNION is about to launch an intensive campaign to educate the public that theaters NOT signed up with the EMPIRE STATE MOTION PICTURE OPERATORS UNION are not employing members of the only organization which is FAIR to its members as well as to EXHIBITORS.

DON'T BE MISLED by rash promises or false statements made by anyone.

The EMPIRE STATE MOTION PICTURE OPERATORS UNION will do everything in its power to protect the interests of EXHIBITORS who recognize the rights of operators to work for a fair wage

EMPIRE STATE MOTION PICTURE OPERATORS UNION, Inc.
4 Court Square Brooklyn, N.Y.
Telephone TRiangle 5-9280

September 17, without any decision as to Kaplan being rendered. Later that week, Fred Dempsey made public a denial that the Board intended to order the removal of Kaplan. Speaking in behalf of President Elliott of the I.A., Dempsey added that, at Kaplan's request, the decision of the Board would not be forthcoming until after the impending trial of Sam Kaplan on conspiracy charges. A special assessment of $25,000 has been levied against the members of Local Union 306 to engage legal counsel in the person of Max Steur, noted criminal lawyer, in the trial of this case.

Case of National Interest

The matter of Kaplan's administration of Local 306 was given national prominence recently when the magazine *Time*, with strong national coverage, presented a resumé of the situation. The story, which was worded in the breezy, informal manner, characteristic of *Time*, evoked an immediate response by Sam Kaplan in the form of a libel suit for $150,000.

A by-product of the case as a whole is the present picketing of practically all the important Broadway theatres (Paramount, Capitol, Loew State, Roxy, Mayfair, etc.) by members of the Empire State Union. Using placards which are practically identical in form and wording to those utilized by Local Union 306, the Empire organization is prosecuting vigorous and extensive picketing operations.

Although the Empire placards blatantly announce that those theatres which employ members of Local 306 are "unfair to organized labor" and will not "permit the affiliation of its operators with a fair and just labor union", the theatres are powerless to enjoin these activities because of a recent decision handed down by the New York State Court of Appeals.

Court Decision Misrepresented

This particular decision, which was publicized throughout the Alliance as a "smashing triumph" for Local 306 in particular and organized labor in general was found upon close study to give Empire State the same status within the confines of New York State as is enjoyed by Local 306—that is, *both* organizations were held to be bona fide labor unions with equal rights and privileges. Incidentally, no correction of the published erroneous reports concerning this decision was ever made.

A particularly vital and interesting sidelight to the picketing activities of the Empire State organization is the fact that in practically all those theatres which were picketed business actually increased—thus erasing from the minds of New York theatre executives the fear of the picket as an important factor in affecting box office receipts.

Sam Kaplan is understood to have entered a vigorous and, apparently, convincing refutation of all charges relative to his leadership of Local 306. Those charges filed by members of 306 were characterized by Kaplan as the "inevitable mouthings of a disgruntled minority", and he hinted that the activities of the opposition really were the product of a desire to turn him out of office so that the opposition might gain control of the organization.

As previously stated, the Board has not yet rendered any decision in the matter, and, in view of recent expressions by responsible I.A. officials, an early decision is not to be expected.

[NOTE: The foregoing article is a recounting of all available information as gathered by INTERNATIONAL PROJECTIONIST and is not designed and should not be construed as constituting an expression of opinion. The opinions of INTERNATIONAL PROJECTIONIST as a publication will, as usual, appear in its editorial page.—EDITOR.]

What! No Prize for Year's Best Projection Work?

THE Academy of Motion Picture Arts & Sciences will soon announce its awards for the "best" efforts of the year in production work. The cameraman, the art director, the recording engineer, the writer, the director and other production workers will be honored. But there will be no award for the outstanding contribution to projection work during the year. The Academy has lately interested itself in the exhibition field; but what executive of importance ever acknowledged the importance of projection in the exhibition field?

F. H. Richardson Asks About Horn Placement

F. H. RICHARDSON advances the argument that there is no need for mounting the sound system horns behind the screens, instead of at the sides. Agreement with Mr. Richardson in this matter would necessarily reflect the view that there is no need for using the perforated screen. Difference of opinion on this topic there will certainly be, but thus far there has not been one bit of fact adduced which would tend to discredit the Richardson theory.

Two Undesirable Features

The perforated screen is known to all thinking projection men as a nuisance; it occasions difficulty in sound transmission and robs the picture of at least 40 per cent of the total amount of available light. Originally introduced to the industry as a catch-as-catch-can proposition, the perforated screen has remained simply because nothing was ever said or done about it.

Much Activity Expected in Sound Equipment Field

WHAT an upheaval there will be in the sound equipment field, if the present plans of at least one major circuit materialize. If and when both the projection and sound fields widen (and contemporary well-informed opinion holds that the "levelling-off" process is already under way), then will the responsibility of the projectionist be even greater than it now is. Projectionists are in for a real thrill when the expected "blow-off" in sound equipment takes place.

Continuous Projectors

WILLIAM C. PLANK, author of "The Art of Continuous Cinematography" which appeared in our November and December, 1931, issues, offers the following reply to questions regarding the inherent error in continuous cinematographs:

> I have often been asked what effect the inherent error in continuous cinematographs has in the projection. At full speed it always resolves itself into a travel-ghost. Therefore, the amount of travel-ghost manifested upon the screen will always be a direct measure of the inherent error. We find that with twenty prisms on a wheel no perceptible amount of travel-ghost occurs. The fewest we have tried is nine, and even then the travel-ghost was not objectionable. This is doubtless due to the fact that travel-ghost never occurs with the full intensity of the light, as with intermittent projection, but with only part of the objective lens exposed, that is, with half of the light intensity or less.

PROJECTOR PATENTS

Flexible Mounting

1,830,596. *Adjustable Mounting For Picture Projection Apparatus, to Augusto Dina; assigned to International Projector Corporation.*

The light and film boxes are mounted on two individual supports which are related, however, by means of pivoting members, so that they may be pivoted with relation to each other upon a vertical axis, or the light box may be adjusted angularly, or they may be slid, with relation to each other.

1,830,601. *Sound Telescope, to Louis Simon Frappier and Ewald Boecking; assigned to International Projector Corporation.*

A telescope, directing a ray of light upon a sound film, is carried by a framework, adjustable longitudinally or transversely with respect to the sound aperture for adjustably relating the focal point of the telescope to the sound record.

Another Pedestal

1,831,344. *Oscillatory Support For Motion Picture Projection Machines, to Augusto Dina; assigned to International Projector Corporation.*

Moving picture apparatus is mounted upon a frame, the angularity of which may be varied by means of a leg, pivotally connected to a base and extensible with relation to the base and the frame, and by means of an adjustable link interconnecting that link and a fixed pedestal for the frame.

1,831,345. *Oscillatory Semi-Automatic Adjustable Support For Picture-Projecting Machines, to Augusto Dina; assigned to International Projector Corporation.*

The lamp house base is mounted upon a pivotally supported member with which is associated an adjustable frame, consisting of a pair of telescoping members. These members are interconnected by means of springs having means for adjusting their tension.

THE WHAT, WHY AND HOW OF SOUND VACUUM TUBES

James J. Finn

***The first of a series of articles on vacuum tubes for sound picture systems — their manufacture, the nature of and reasons for the materials used, and the ultimate effect of both of these factors on operation. The information contained herein is unique in that it was gathered at first-hand by the writer in the course of a tour of inspection of one of the world's largest research and manufacturing organizations.*—Editor.**

WHETHER the article in question be a ship or a shovel, a skyscraper or a skate, a vase or a vacuum tube, the essential factors that make it a good or a poor article lie in the care and attention paid to what we shall call the "critical details" of design and construction. Knowledge, experience, and the research which in turn produces added knowledge and experience, are all necessary, firstly to determine just which *are* the critical details, and secondly, when these have been determined, to find out how they may be controlled in order to make the product *uniformly and invariably reliable.*

Two important considerations in the design of a commercial type of vacuum tube are the cost of operation, which consists chiefly of the cost of the power required to heat the filament, and the cost of replacement when the filament burns out. This makes the filament a very important element, and its importance is increased by the fact that it is the original source of the electron stream, on which depends the life-work of the vacuum tube. The filament will therefore be the first element of tube design to be considered.

Broadly speaking, vacuum tubes may employ either a plain solid metal filament of tungsten, tantalum, osmium, nickel, etc., or else the filament may be coated with one or more of various oxides which have been found to have a much higher degree of emissivity than the metal alone, that is, the ability to throw off electrons much more copiously.

Types of Filaments

Economic considerations had, from the beginning, led the Bell System to investigate exhaustively the fundamentals of tube design and manufacture. One of the most important objectives of this work was to determine the relative merits of solid and coated filaments, so that each type could be utilized for whatever type of service it was best suited. For applications of the kind involved in sound picture work, a platinum alloy filament coated with a mixture of barium oxide and strontium oxide has been found the cheapest and most satisfactory in the long run, although relatively expensive in first cost.

Experiments in the preparation of filaments have shown the remarkable effect that barium has upon the activity of a platinum filament. The characteristic in Figure I shows the variation in the plate current with a given filament current, which results from a variation in the coating of barium applied to the filament. Emission, it will be noted, increases enormously after 85 per cent. of the filament surface is coated with a single layer of barium.

When the filament is coated with more than enough barium to cover its surface, emissivity drops off and approaches the value it would have for bulk barium. The remarkable fact is that the electron current obtained at any heating temperature from a single layer of barium atoms on a platinum wire is enormously greater than the electron current which could be obtained from a filament of either substance alone.

In the filament of commercial W.E. vacuum tubes, for example, a platinum alloy core is covered with a thick coating containing the oxides of barium and strontium. The strontium oxide is employed to retard the effect of evaporation of the barium, thus increasing the effective life of the filament. During the course of manufacture of the tube the core becomes coated with metallic barium which has been liberated from its oxide and more of this metal is stored up in the remaining oxide coating.

While the tube is being used some of the stored barium is held upon the surface of the oxide as an invisible film, and experiments show that this film behaves like the barium direct on platinum, that is, it increases the electron current and is responsible for the very high efficiency of the oxide coated filament.

Vacuum Tube Operation

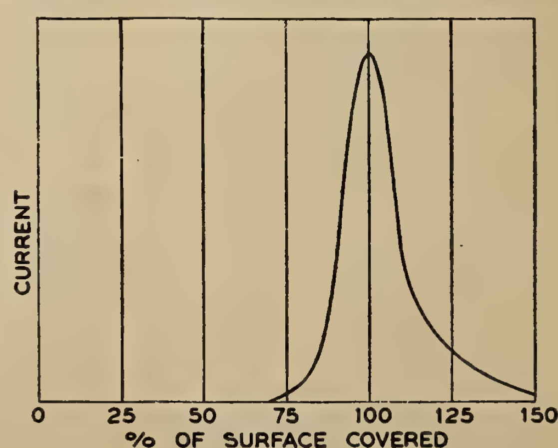
To fully explain this efficiency it is necessary to clearly understand the principle of operation of the vacuum tube and while this knowledge on the part of the reader may be correctly assumed, it might be well to briefly run over the high spots of vacuum tube operation for those who may have become a little rusty.

When an uncoated filament is heated by the passage of current, electrons are thrown off by the atoms of the metal of which it is composed. Each of these electrons represents an elementary negative charge. The atom from which it came is said to be *ionized*—that is, through the loss of an electron it has become positively charged. It therefore tends to attract an electron back to it.

The net result is that when free elec-

FIGURE 1

Curve showing how the emission from a platinum filament increases as a layer of barium atoms cover more and more of the surface



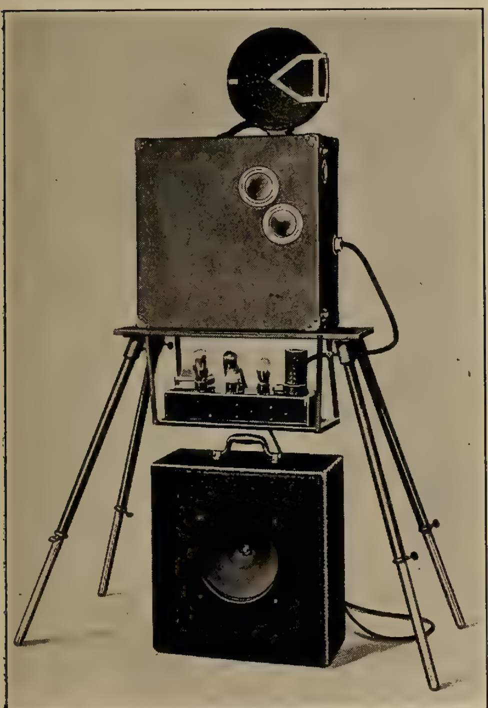
trons reach the surface of the filament, they encounter a strong pull, tending to prevent them from leaving the surface, owing to the attraction exerted by the ionized atoms at the surface. A few escape, but most are pulled back, so that one might picture them as bubbling in and out of the surface. The electrical force which tends to keep them from getting beyond the surface resembles, in fact, the molecular tension at the surface of a liquid. The electrons might be said to have to climb an electrical hill. Those which do escape do so by virtue of starting off with enough speed to carry them over this barrier.

The reason for the value of the barium coating can now be simply explained. Like the atoms of the metal of which the filament is composed, the barium atoms give off electrons when heated, and so become positively-charged ions. As they lie on the surface of the filament, they constitute a kind of positively-charged grid tending to pull the electrons out of the filament and give them the speed necessary to enable them to get clear of the filament for good. On the other hand, if there are too many barium atoms on the surface of the filament, they obstruct the electrons when they are trying to emerge, and so the emission tends to fall off again, as may be noted in Figure 1.

The barium oxide coating used on filaments is comparatively thick, but during the process of manufacture the tube is so treated that a layer of barium only one atom deep is formed on the surface. Thus the advantages described in the last paragraph are fully realized.

Figure 2 shows very conclusively how the oxide coating permits filament temperature to be reduced, thereby effecting a large saving in current and prolonging the life of the filament, since filaments age rapidly as the operating temperature is increased.

In their tube research the Bell System



DEVELOPMENT AND USE OF THE SOUND PICTURE

(*Continued from page* 16)

fundamental tones. With the vowel sounds some of the frequencies which are characteristic may lie as high as 3,000 to 4,000 vibrations per second. Many of the consonants and particularly the sibilant sounds require as high as 8,000, or more, cycles for their faithful reproduction. It is therefore seen that the frequency range necessary for complete naturalness of speech is approximately 100 to 8,000 cycles. The volume range for speech is not large and may ordinarily be handled without difficulty by a recording and reproducing system.

With music a much wider range of both pitch and volume is necessary. The fundamentals of the bass instruments require frequencies below 40 vibrations per second, while the majority of the other instruments, particularly the percussion group, require above 10,000 cycles for faithful reproduction and for bringing out their full emotional musical value. In the case of music the volume requirements are also very severe. A symphony orchestra may easily have an average volume range of 66 decibels with instantaneous peaks of energy up to 75 or 80 decibels.

The tinkling of keys is about the highest pitched sound that the ear can perceive, and the rumbling of the lowest organ notes the deepest it can detect, a range of about 9½ octaves. Artillery fire is about the loudest sound the ear can endure; while the faint rustling of leaves is about the faintest sound it can detect, an energy ratio of 100 million million to one. Any apparatus which is designed to reproduce all sounds faithfully must be capable of handling a sufficiently wide range of pitch and volume to produce an illusion of naturalness, must have a delicacy of response sufficient to reproduce the finest shadings which the ear is capable of perceiving and must do this without introducing outside or extraneous sounds.

Development of the Art

Although sound had previously been recorded by various methods, Thomas A. Edison was the first to record sound in such form that it could be used again to vibrate a diaphragm and thus reproduce sound. Edison's invention was made in 1876 and patented in 1877.

Prior to this invention, all records of sound had been in the form of a wavy line. Edison's records were on a cylinder with a spiral groove over which was placed a thin sheet of tin foil. A steel stylus was attached to a drum head of gold beaters skin and as the cylinder was rotated the vibrations of the diaphragm served to impress through the stylus a groove of varying depth into the tin foil. When allowed to again traverse this groove the same device emitted a

barely recognizable reproduction of the sound.

Bell and Taintor later studied this method and concluded that the rubbing process had to be abandoned and an engraving process substituted, that is, instead of pushing the surface of the record down in a spiral groove it was necessary that the material be dug out or engraved into the record. As a result of their experiments they obtained a patent in 1886, and issued the graphophone in 1887, the first practical apparatus of the phonograph type.

In 1887 Emile Berliner, who had been concerned in the early developments of the telephone, patented the gramaphone. He concluded that the forces required to cut a groove of varying depth were much greater than those available in the human voice, so he returned to the earlier ideas and proceeded to make a lateral cut record. He also concluded that it would be more convenient if these records were in flat or disc form. Berliner cut the record from below so that the material removed would fall away while the record was being cut, and then etched the disc chemically. Later the substitution of an electroplating process in place of the etching made this form of duplication the type commonly used commercially.

All the earlier attempts to record and reproduce sound by mechanical methods suffered under the limitations imposed by the minute power of the originating source, the inertia of the apparatus itself, and the unnatural conditions under which the recording artists were forced to work. It was not until electrical transmission and amplification of sound as developed in the telephone were applied to recording and reproduction that a product of commercial quality and amplitude was obtained. Hence the invention of the telephone in 1875 by Alexander Graham Bell is one of the most important progenitors of the talking motion picture.

Vacuum Tube Vital Factor

Of all the inventions utilized in sound recording and reproduction perhaps the most vital is the vacuum tube, as it provides power. Its property of unlimited amplification without change in the characteristics of an electrical current made possible the long distance telephone, brought the radio into existence and overcame the mechanical limitations of the old acoustic phonograph.

It was in October, 1912, that Dr. Lee DeForest, after several years of research and experimentation, brought his patents to the Bell Laboratories and made a demonstration of his three-element audion. The performance of these tubes was far short of the requirements for handling loads comparable to those in commercial telephone circuits, but Dr. Arnold of the Laboratories quickly diagnosed the trouble as arising from the erratic effects resulting from gas ionization within the tube occurring at higher voltages, and concluded that a commercially successful telephone repeater could be made from the DeForest audion if the gas were removed and the audion converted into a vacuum tube.

The transformation of Dr. Bell's original fundamental invention into the transcontinental long distance telephone was brought about not by the inventive genius of one man but was effected through the medium of organized research, through the efforts of many men. Dr. Bell's original little workshop grew into a great research organization, the Bell Telephone Laboratories. This organization was continuously working to extend the telephone technique, which heretofore had been limited to the transmission and reception of commercially intelligible speech requiring a sound spectrum of from 200 to 3,000 cycles and a comparatively restricted volume range, to a point where the whole range of audible sound could be encompassed.

During the war the energies of the Bell Laboratories research staff were of necessity directed toward the development of apparatus for war purposes, which included equipment for radio communication and for sensitive, high quality detection of sound. In the course of this work many refinements of the telephone were developed; the telephone transmitter was glorified into the microphone; the telephone receiver had grown into the loud speaker.

Immediately after the war, work was actively resumed on the improvements of sound transmission and reproduction. Resulting from this work there appeared in the next few years voice reinforcing apparatus known as "public address systems", high quality broadcasting, electrical recording, and the "orthophonic phonograph". Also picture transmission by wire and the printer telegraph had been developed, these involving problems of synchronization similar in many respects to the synchronization necessary in talking pictures.

Basic Requirements

By 1925 most of the elements for a successful talking picture system were in existence. These basic requirements included:

1. Frequency or pitch range of not less than 100 to 4,500 cycles.
2. Volume or loudness range of not less than 30 to 35 decibels.
3. Ability to pick up sounds at a distance from the performer so that the actor

has the necessary freedom of movement to permit natural photography.

4. An easily adaptable means of synchronizing both the recording and reproduction in the taking and projecting of the picture.

By this time the motion picture had become one of the country's large industries. From the nickelodeon and the little store-theatre in the mining and steel centers of Pennsylvania, it had grown in twenty-five years to a rank among the first ten of our large businesses. Its leaders were mostly men of humble origin but with imagination, daring and infinite capacity for hard work. The fascination of the work as well as the large commercial rewards had attracted a young, vigorous and resourceful personnel from all walks of life.

I mention this, as the type of man power running the motion picture industry was an important factor in the successful revolution resulting from the adoption of sound which was about to take place and I doubt if any other industry ever endured so complete an upheaval in so short a period.

One may wonder why such a transformation was undertaken. Frankly it was not entirely voluntary and furthermore the completeness of the change and the problems involved were not realized. But something was wrong. For several years the industry had not only not shown any growth; there were indications of actual decline. In looking back the reason now seems quite clear. In endeavoring to supply the quantity of pictures required the material for stories was becoming exhausted and the emotional quality of much of the product was failing to hold audiences.

The talking picture opened up an almost limitless supply of new material; speech, music and sound effects. It made available the whole dramatic stage and provided a medium unhampered by many of the limitations of the stage such as space and time and tempo. The story to be told could flow through from beginning to end without interruption, without losing the audience through scene shifting. Its possibilities even yet are barely touched.

The First Step

In the spring of 1926, the Warner Brothers undertook to utilize this new medium. A makeshift sound studio was established in the old Manhattan Opera House on 34th Street in New York. Seats were removed and the stage built out over the orchestra floor. Recording apparatus was moved over from the Bell Laboratories and there was set up a more or less complete sound system. One box became a generator room, another a battery room; the dressing room of many a former star became a recording room; Oscar Hammerstein's famous reception hall on the second floor became a monitoring and review room.

During the summer the complete score for the new silent picture Don Juan star-

ring John Barrymore was recorded; the New York Philharmonic Orchestra played the overture to Tannhäuser; short numbers were made by Marion Talley, Anna Case, Harold Bauer, Martinelli, Mischa Elman; an introductory address by Will Hays was recorded. The Warner Theatre meanwhile was equipped with reproducing apparatus.

An Art Is Born

On the evening of August 6, 1926, this program was presented to the public in Warners Theatre, N. Y. The effect on the audience was startling, and as far as the motion picture industry was concerned, sound came to the silent screen that night.

This first program was recorded entirely on discs similar to the phonograph, only larger and revolving more slowly, so that one record could play the ten minutes required to project one reel, approximately 1,000 feet, of picture. In January, 1927, William Fox showed sound recorded on film and followed soon with the first Movietone news reel. The following October, Warners presented Al Jolson in "The Jazz Singer," which incorporated the first use of dialogue in a full length feature picture.

By 1928 the rest of the motion picture industry was confronted with the alternatives of "going talkie" or seeing Warner and Fox run off with their business. These two had dared risk a substantial investment by making sound pictures with very few theatres equipped to show them and about 150 theatre owners had gambled $10,000 to $20,000 each in equipping their theatres to show talking pictures.

But the response of the public indicated that the vicious circle was broken. In May the industry took the plunge. The question was not "How much will it cost?" but "How soon can it be done?" By midsummer 5,000 men were at work in the telephone plant of the Western Electric Company in Chicago manufacturing equipment, while fully as many more were engaged in building and equipping sound stages at the studios in Hollywood and in installing reproducers in theatres.

PROJECTION PROBLEMS AS SEEN BY THE OWNER-MANAGER

(*Continued from page* 25)

sound screens begin to fade or become discolored they must be replaced with new ones. So here again we find an important item of theatrical equipment about which so many exhibitors know little and on which they can get still less satisfactory information, other than from salesmen.

It will surprise you to know how many screens are too small for the theaters in which they are installed. No doubt, a great deal of complaint must come from the patrons of such theaters, especially where the smallness of the projected image makes it extremely difficult for patrons sitting at a distance from the screen to obtain a clear definition of the characters. The Society might suggest to many of these exhibitors that they determine the possibility of enlarging their picture by merely changing the masking and the lenses.

I recall visiting, a short time ago, a theater in which the projected picture was small. I asked the owner why he did not increase its size by at least fifty per cent, and was informed that he could not afford to spend the money for a new screen and new lenses; a reply that emphasized the unfortunate ignorance of many theater operators, whose screens might be large enough, but who masked them to conform to the size of the image projected by their present lenses.

Reverting to the question of projection room equipment, there must be considered, in addition to the projectors themselves, the various forms of transformer, generator, rectifier and rheostat; also, the type of lamp house and arc employed, because when all is said and

done, the power of the arcs determines the definition, clearness, and brightness of the picture projected upon the screen.

Print Density

Quite often, complaints are registered that the projection in a theater is poor: the picture is much too dark. This I have found, in most cases, to be due not so much to the equipment as to the darkness of the particular print shipped by the distributor. If the distributing companies would refrain from circulating dark prints, this trouble would be eliminated.

I have made it a point to inquire of theatrical men throughout the country what they thought of the possibilities of wide film, and in view of the physical layout of the majority of theaters outside the key cities, the introduction of wide screens would be not only impracticable, but in many cases impossible. The present size of picture, in the opinious of most theater managers, should remain; no change should be made at this time.

Projection Today

THE motion picture projector is no longer a mere mechanical contrivance, cranked by hand, or made to operate by the simple closing of a switch. The Projectionist of Today must have an excellent knowledge of mechanics, electricity and optics and is in charge of a delicate and complicated mechanism made with scientific accuracy to handle a fragile and inflammable material.

THE projectionist has a great responsibility—for a failure to measure up to the right standards means that all that the producer, the director, the actor and the cinematographer have striven for loses much of its artistic and commercial value—the pleasure of the audience is lessened, the exhibitor is subjected to constant and unnecessary expense, and lives and property are endangered.

(*Courtesy,* International Projector Corp.)

THE WHAT, WHY AND HOW OF SOUND VACUUM TUBES

(*Continued from page* 28)

has not confined attention to the study of oxide coated filaments alone, but has included a survey of the thermionic properties of all available refractory substances and a thorough investigation of those which showed promise of commercial value.

Why a Platinum Filament?

The reason platinum alloy is used in Western Electric tubes instead of some cheaper base metal, such as tungsten, is because the barium and strontium oxides, which, as previously explained, are preferred as coatings for the metal filament, do not form any deleterious compounds with this alloy. When these oxides are used on tungsten or other base metals, excepting nickel, compounds are formed between the metal core and the oxide coating which reduce the number of electrons emitted and so destroy the desirable property possessed by the coating of being able to emit electrons copiously at low temperatures.

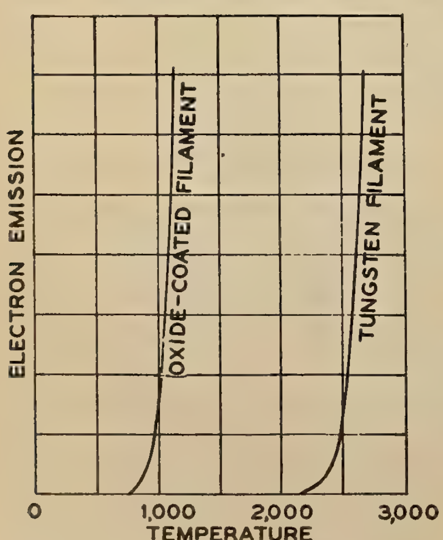


Fig. 2. Electrorn Emission and Temperature

The elements alloyed with the platinum are nickel and cobalt; they are valuable in affording a combining base for the oxide coating.

The platinum used in the filament core in 99.98 per cent. pure. It is obtained first in sponge form as a gray, powdery material, not at all like the platinum seen in jewelry. This sponge is treated chemically to dissolve out its impurities and is pressed into pellets and melted in an induction furnace at temperatures around 3,400° F., with the alloying elements just mentioned. The melt is then pressed into bars which are afterward rolled and swaged until a rod ¼″ in diameter and 3 or 4 ft. long is obtained.

At this stage each little section of the bar is fused with an oxhydrogen torch to work out gas pockets and air bubbles remaining embedded in the metal. Unless this is done the gas pockets are drawn out with the metal in the wire drawing process, which causes the wire when reduced to a small size, to break. The wire from which the ribbon is to be rolled is drawn down to diameters varying from .001″ to .013″, depending on the type of tube for which it is intended.

The final step in the production of the filament core is an accurate inspection of its size. In order to insure the proper electrical characteristics for the tube, it is necessary to check the filament core to such close dimensions that even the most accurate of micrometers is not exact enough to measure the dimensions within the limits required. The cross-section of the wire is therefore determined by weighing samples of it a meter long.

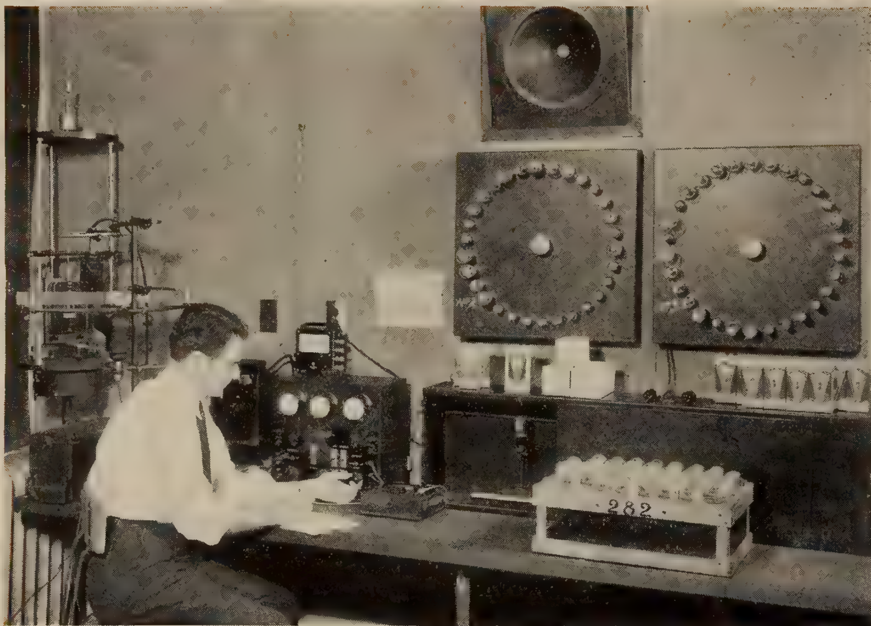
Check on Accuracy

After the wire has been rolled into ribbons, the width of the ribbon for the filaments, where the greatest accuracy is required, is determined by projecting an image of it magnified a thousand times on a screen. This screen is calibrated so that it is possible to tell at a glance whether the ribbon falls within the required limit to a very accurate degree.

Improvements in the platinum core and in the coating and pumping processes have made it possible within recent years to increase the life of vacuum tubes many times, with large resulting savings and great improvement of service.

After the filament has been properly prepared, ready for use, it must be mounted upon a suitable support in proper relation to a grid for controlling the electron stream; there must also be provided a conducting plate for collecting the electron stream that it emits. This assembly, termed the mount, is inserted in a glass bulb of suitable size and shape which undergoes an evacuation process to exclude all deleterious gases, after which operation it is permanently sealed from the air.

[Note: The second in this series of articles on vacuum tubes and photo-electric cells will appear in the next issue. This forthcoming installment will include a discussion of the evacuation process and methods of testing for electrical and mechanical values.—Editor.]



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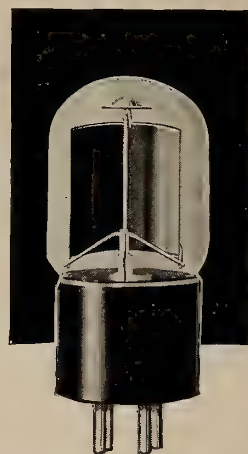

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MONTHLY CHAT

THAT story relating to fake projection and sound picture schools which appeared in our last issue went over with a very loud bang, the reverberations of which still are audible. Particularly appreciative of this material were the Pacific Coast men, who long have been harrassed by fake projection school promoters. Several wires flashed from the Coast to our extensive suite of offices in New York; and within the hour bundles of extra copies of INTERNATIONAL PROJECTIONIST were westward bound. How these copies were used we can only surmise, but we are sure that they served a good purpose. This is the sort of service which I.P. delights in rendering, the sort of service for which I.P. has become outstanding in the projection field. Thank Yager, of Salt Lake City, for a nice bit of reportorial work. More of our readers should develop the instinct to recognize a good story when they see it. Are we modest? Not at all.—*Adv.*

WE ask that every projectionist purchase just as many Christmas Seals this year as he possibly can. The Seal drive will extend from Thanksgiving to Christmas. If the craft only could know of the really marvelous work done by the National Tuberculosis Association, sponsor for the drive, for hundreds of projectionists, the pennies would come pouring from thousands of pockets in exchange for Seals.

LAST month we thrust out our chest and promised that in this issue would appear an analysis which we tentatively titled "One-Man vs. Two-Men Sound Shifts". The material was prepared and all ready to run. Suddenly it developed that the data might be used to greater advantage in a more important quarter. We beg our readers' indulgence for another month, or two at most.

Turning to the brighter side of things, we note that Mr. M. D. O'Brien at last has come through with the first installment of a series of articles on a new national code. His partner in crime, Mr. Lester Isaac, also contributes an article which reads to us as though he were geting a load off his chest. Good stuff, too. Mr. Chauncey Greene, one of the outstanding men in this field, finally emerges from under a bushel and writes a funny kind of little story—with a tremendous theme running in and out between the lines. My, my, we worked hardly at all this month.

ORGANIZATION activities being what they are, it is not surprising to hear from those not closely in touch with the craft that the Projection Advisory Council is dead. Mr. Thad Barrows, P.A.C. prexy, dislikes very much the sound of such words, the extent of his displeasure being on view in an article in this issue. Incidentally, be prepared to hear some big news about the Council shortly.

INTERNATIONAL PROJECTIONIST

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ORGANIZATION: A PROBLEM FOR THE INDIVIDUAL

Lester Isaac

DIRECTOR OF PROJECTION & SOUND, LOEW'S THEATRES, INC.

THE success of Unionism, its widespread influence upon every worthwhile activity in this country, is clear evidence of the value of organization. Power of any kind is seldom exerted effectively by one individual and practically every great name in history has been representative of some large institution. The prosperity of the motion picture projectionist in recent years has been largely due to his holding a Union card. No matter what natural ability or willingness to work he might possess, he was strengthened by his membership in the I. A., and this organization in turn was made more influential through its affiliation with the American Federation of Labor.

It is safe to say that every banker, merchant, manufacturer, lawyer, doctor, etc., is a member of some large organization in his own field; and every craftsman should belong to some organization which can look after his interests better than he as an individual could do so. Sometimes members expect too much from the heads of their organizations, for, after all, even a large institution finds that it has certain well-defined limitations. Any association, society or council is merely a body of men seeking certain results for its members through collective thought and action. The impossible should not be expected, and individual members must have a full sense of their responsibilities to their organization. They should be willing to cooperate in every possible way and continue their confidence and support even in the face of failures and discouragement.

There are certain undesirable conditions which only time will correct. The unionized projectionist is suffering from the present depression and cannot very well escape many of its hardships. We may be certain, however, that the projectionist will successfully emerge from present conditions and continue to go forward as he has in the past. The men who are at the head of this industry when prosperity returns will be experienced men who realize the value of experienced employees. The recognition which many projectionists have received recently very clearly indicates that the industry now has a much better understanding of the highly skilled, specialized training of the competent projectionist.

Individual Responsibilities

It is important that the projectionist continue to keep before him the thought that he cannot depend solely upon his organization membership. The individual surrenders a certain amount of his independence when he becomes a member of any organization and must obey its rules and regulations. Too often, however, men seem to feel that in becoming a member of an organization they surrender *all* individual responsibilities—having a card and having a job, there is nothing further to do. Some seem to believe that they may do as little work as possible for the greatest possible compensation and that their union card will fully protect them in this. They forget

Lester Isaac

the old saying: "A chain is as strong as its weakest link."

The strength of any organization depends on the kind of men in that organization: if they are careless, incompetent indifferent and unprogressive it will be *weak;* if they are intelligent, ambitious, skilled and conscientious, it will be strong. An organization has a right to insist that every individual be an asset; on the other hand, the organization has an obligation to see that its members are afforded every facility for rendering the highest type of service.

Projectionists, as a group, made a splendid showing with the coming of sound and the many novelties which were introduced with the vast expansion and prosperity of the motion picture industry. This, however, was largely a result of the private preliminary work done by a comparatively limited number of progressive projectionists. Few locals make any official attempt to see that their members are trained and informed regarding improvements. It is regrettable that in many locals the progressive projectionist is ignored, if not actually belittled.

I. A. Service Bureau

That the projectionist made a mighty good showing was largely due to his fundamental, practical training and quick adaptability; but I do not think that he should again leave himself open to the danger of being without adequate information or of being unaware of the possibilities of radical change and improvement in the projection field. Furthermore, I think that the I. A. should see to it that its organized membership be always better informed than the unorganized man.

Quality of workmanship and service will always be a consideration in all labor adjustments. If the I. A. man proves that he is more competent and more dependable than the unorganized man, we can be sure that this will be an important consideration in all wage settlements. The I. A. should have a research department, and this could render a service of inestimable value for a comparatively moderate cost. American industry has set an example to the entire world and owes much of its tremendous success and advancement industrially to its organized facilities for research.

It required a century to develop the basic idea of Michael Faraday and from it create the electrical industry as we know it today; but now the same development would take place in five or six years as a result of our vast facilities for research. The rapid developments of the automobile and radio industries were largely the result of research. The success of research in this country is an American romance, but it is a story full of great practical meaning. The research worker and the research departments look forward to tomorrow realizing that nothing is permanent in this world and that change comes rapidly.

There are books, technical organizations and craft papers which undoubtedly serve an excellent purpose in keeping the projectionist in touch with what is new along technical lines. A research department supported by the I. A., however, would systematically investigate and inform the projectionist well in advance of the practical introduction of any new development. The progressive projectionist would be only too glad to avail himself of advance information; and the unprogressive projectionist would have difficulty in ignoring it. It is fair to assume, then, that the standing of all projectionists would be raised and that the organized I. A. projectionist would secure the confidence and goodwill of every owner and manager who was competent to run his own business.

Of course, we shall always have the incompetent projectionist and the incompetent manager. But we can also be just as sure that we shall have the competent projectionist and the competent manager, who have a full realization of the value of skilled craftsmanship. The research department of the I.A., or any other method of attaining the same object, would give a more certain assurance that the members of the I. A. would always be in demand except by those owners and managers who are willing to sacrifice the safety and pleasure of the audience to save a few dollars.

I am firmly convinced that quality pays and can demand its price.

Let us make certain, therefore, that the I. A. man is a credit to his organization by being at all times superior to the unorganized, incompetent, undependable individual who comes into this field with little or no training because he thinks there is an opportunity to make easy money. In the end he is gobbled up by the owner or manager who will sacrifice anything to save a few dollars. The skilled projectionist is the true answer to everyone in this industry who is willing to risk the dangers of incompetency in order to make or save a few dollars.

DEVELOPMENT AND USE OF THE SOUND MOTION PICTURE

H. M. Wilcox

VICE PRESIDENT, ELECTRICAL RESEARCH PRODUCTS, INC.

From time to time INTERNATIONAL PROJECTIONIST *is asked to supply data relative to the chronological development of the art of sound motion pictures. The accompanying article, a reprint of a paper presented by Mr. Wilcox before the Franklin Institute of the State of Pennsylvania, is a comprehensive and technically correct exposition of the development of this art.*—EDITOR.

II. Development of Technique

AFTER construction came the development of studio technique, which involved problems from the selection of the story and the writing of the scenario clear through to the final completed picture. There was no time for laboratory experimentation and the technique of using this new instrument had to be developed under the pressure of actual commercial production. I shall touch briefly on a few of these problems.

The question arose as to the relative merits of disc and film recording. Both technical and commercial considerations were involved. When the sound motion picture was ready for commercial release in 1926, recording on discs and the processing of the records were already an established industry and the facilities of the phonograph companies could be utilized for making records. On the other hand, while film recording was even then fairly well developed in the laboratories it had never been applied commercially and both delay and risk were hazarded if it were adopted. So the disc record was generally adopted at first.

It soon became evident, however, that the cost of distributing pictures would be greatly increased where both film and discs had to be handled and, in addition, operating difficulties were encountered through careless adjustment of the films and discs on the reproducing machines, resulting in pictures and sound being "out of step" with complete loss of illusion. I remember distinctly at one of the early performances at the Warner Theatre[1] seeing Martinelli appear on the screen singing a banjo solo! Also, film records furnish a much more flexible medium, as the film can be cut and patched at will and later, after the picture is released, any deletions required by the censorship in different states can be readily handled; whereas with disc records this is very difficult or impossible.

To appreciate the technical consid-

[1] Broadway, New York City.

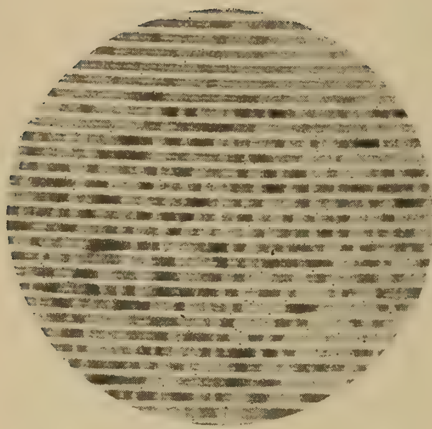


FIGURE 1
Vertical cut (hill and dale), disc record

FIGURE 2
Lateral cut disc record

(Both views greatly enlarged)

erations involved some understanding of the two methods of recording is desirable. Please bear in mind that in either method two dimensions, namely *pitch* and *volume*, must be written on a single plane surface.

Sound Recording Methods

In disc recording a groove is cut on a soft wax surface by a recording stylus vibrated by amplified sound currents. These vibrations may be either vertical or lateral. Edison's original method employed the vertical method, which has since been termed "hill-and-dale" recording. Here the center line of the groove is a perfect spiral while the vibrations are recorded by varying the depth of the groove. In lateral recording the depth of the groove remains constant while the vibrations of the recording stylus are imprinted in the wax in the form of a wavy line through the displacement sideways of the walls of the groove.

In both methods *pitch* is recorded by the number of vibrations imprinted per revolution on the wax matrix; while *volume* is recorded by the velocity of displacement of the groove, the louder the sound at any given frequency the deeper the cut on vertical recording, or the greater the lateral displacement of the walls of the groove in lateral recording.

There are also two methods of photographic or film recording known as the *variable area type* and the *variable density type.* Fortunately both of these can be reproduced on the same machine without any change in the mechanism, which is not the case with the two types of disc recording. In the variable area method the sound is written by a mirror galvanometer as a series of sawtooth valleys and peaks, pitch being recorded by the number of these in a given length of film, while volume is recorded by their depth or height.

The variable density record consists of a series of small parallel lines of varying photographic density and distance apart, the varying degrees of density recording the volume and the distance apart of the striations recording the pitch. This form of record is obtained through the focussing of a bright light through a narrow aperture formed by two tightly stretched wires placed close together in a magnetic field. A variable current representing sound waves converted into electrical energy at the microphone passes through these tightly stretched wires causing them to vibrate in exact conformity to the vibrations of the sound waves. The film negative travels at a constant speed past the aperture and receives the impression in the form of tiny parallel lines of varying degrees of lightness and darkness and varying distances apart.

A modification of this method is to vary the intensity of the light source by connecting the wires leading from the microphone to the terminals of a flashing lamp projecting through a fixed aperture. This is termed the *flashing lamp* method, while the fluctuating wires is called the *light valve* method and is the method utilized in the Western Electric system.

Both of these methods of variable density recording are in practical use, the "flashing lamp" type mainly in newsreel work, the "light valve" type mainly in studio work, as the quality of product has so far proved cleaner and more uniform with the latter owing to the greater intensity of light delivered to the negative so that full exposure of the film can be obtained.

Reproducing Process

The reproducing process is the reverse of the recording process and bears a resemblance to the radio receiver, differing mainly in the source of the impulse which comes from either a film or disc record instead of from electrical vibrations in the ether. The sound record on the disc vibrates a needle attached to an electro-magnetic device which converts the vibrations into an electric current. The film record is passed at a uniform speed through a narrow line of bright light, focussed on the sound track. Behind the film is a photo-electric cell. The lines in the sound track interrupting the light reaching the cell generate in the cell a fluctuating current of the same characteristics as the original sound. The current from the reproducer is then amplified, transmitted to the loud speaker and re-converted into sound.

A motion picture is in reality a mosaic, the assembly of a great number of short takes; a series of episodes, each one flowing into the next to make a continuous smoothly-flowing story. Through one scene may appear in several different places in a picture, it is obviously economical to build the set once and to take all of the scenes appearing on this set in succession and then later "cut" each into its place in the picture. In fact, the final cutting, editing and assembly of a picture is one of the very important operations in its construction. With the advent of sound this method resulted in some difficult technical problems, this being particularly the case with disc recording.

One of the serious problems encountered was that of maintaining a uniform recording level when adjacent scenes in a picture may have been taken weeks apart. It is obviously too much to ask the thousands of projectionists in theatres to continuously manipulate the reproducer levels to compensate for varying recording levels. In fact, it is essential that the human element in reproducing be eliminated as far as possible and that all of the shadings of loudness or softness be incorporated in the original film and that little or nothing be left to the discretion of the theatre projectionist in playing.

Re-Recording or "Dubbing"

To meet this difficulty an operation known as "dubbing" or re-recording had to be perfected and adapted to talking pictures. This consists of running the final assembled picture through a reproducing system, the output of which is connected to a recording machine instead of two loud speakers. While the picture is being thus run, the output levels from the reproducing machine can be adjusted at will, incidental sounds separately recorded can be superimposed, and a re-recorded picture produced which incorporates all of the shadings of sound and any special sound effects desired by the producer or director and which can be reproduced from beginning to end with but a single setting of volume level in the theatre.

To obtain a satisfactory sound record on film it is necessary to exercise a considerable degree of technical control of the developing and printing processes and to operate under formulæ maintained within certain permissible variations. It was found that there was little or no standardization in the developing and printing formulæ as related to the picture and that the control of processes ir

(*Please turn to page* 32)

THE W. E. 262-A 'HEATER TYPE' A. C. VACUUM TUBE

SOUND picture engineers have long been aware that there are many advantages to be gained from the use of A. C. for supplying the current necessary to heat the filaments of vacuum tubes. Of course, the main advantage is the elimination of motor generators and storage batteries and the inconvenience of maintaining them.

Before the introduction of the so-called "heater type" A. C. tube, it was practically impossible, because of the A. C. hum, to use A. C. to heat the filaments of any amplifier tubes except those in the last stage of amplification. The development of the "heater type" tube greatly reduced the noise level of the A. C. hum with a corresponding increase in the field of usefulness of the tube.

In this particular type tube the active material which throws off electrons is not the conductor through which the heating current passes. The heating element is imbedded in an electrical insulator in the form of a cylinder which, in turn, transmits the heat to a metal shell which surrounds it, the shell being covered with the active material. Although the "heater type" tube resulted in a considerable reduction in the A. C. hum, such tubes still were too noisy to be used in the first stages of an amplifier.

Studies of A. C. Hum

Realizing the need for a more quiet A. C. operated tube, the Western Electric Co., through its research organization, the Bell Telephone Laboratories, undertook the development of such a tube. This development has resulted in the introduction of the W.E. 262-type tube recently made available. The fact that this tube can be used in the preliminary stages of an amplifier, even under severe vibration condition, shows how successful this development was. The difficulties to be overcome were two: (1) the elimination of A. C. hum and (2) the reduction of noises resulting from mechanical vibration of the tube.

W. E. 262-A tube

In order to determine the source of A. C. hums, a series of delicate tests was worked out and testing equipment designed. The conclusions reached through these tests were that the hum arose from three sources: (*a*) the electric field of the heater element, (*b*) the magnetic field of the heater element, and (*c*) resistance leak and capacity between the heater and the grid and plate. By more complete shielding of the heater circuit, it was possible to reduce the electric field

CHARACTERISTICS

Western Electric 262A vaccum tube — a three element tube having an indirectly heated cathode which permits operation of the heater element directly on alternating current.

Rating

Normal Filament Voltage	10 v. AC or DC
Heater Current	0.29 to 0.35 amp.
Average Heater Current	0.32 amp.
Maximum Plate Voltage	180 volts
Grid Voltage	— 4.5 volts
Average Plate Current	3.0 milliamperes
Amplification Factor	15
Plate Resistance	16,000 ohms

Dimensions

Maximum Diameter	1-13/16"
Maximum Length	5¼"

to a sufficient degree. The magnetic field was decreased by special design of the heater unit and by decreasing the heater current with a corresponding increase in the resistance of the heater element. The resistance between elements was increased by carefully designing the insulator which supports them so that there is no continuous path between any of these elements on the side facing them.

In order to permit the tube to be used satisfactorily directly from the output of a photo-electric cell, the capacity between the grid and heater must be very small, a condition obtained in the new tube by bringing the grid lead out at the top of the tube.

The steps taken to reduce the noises resulting from mechanical vibration of the tube are very interesting. Tubes for use in photo-electric cell amplifiers are especially subject to vibration, particularly as the amplifier is sometimes mounted directly on the sound head.

Tube noises resulting from vibration have two causes. The first is commonly known as "microphonicness" and is caused by the motion of the grid, filament and plate with respect to each other when the tube is subjected to vibration. The effect of microphonicness is to produce an unpleasant ringing noise. The second type of noise is a sputtering caused by the making and breaking of electrical contracts between two parts which are not otherwise electrically connected. This noise sometimes results from loose filament supports or from insecurely welded parts in the grid structure.

In the W.E. 262-A tube both the microphonicness and the sputtering have been greatly reduced by careful attention to its design. The new tube is normally used with a plate voltage of 135 volts and a negative grid bias of 4.5 volts. Under these conditions, the plate current is 3.0 milamperes, and the voltage amplification factor is 15. The total noise reduction obtained through the use of the new tube is of the order of 20 decibels.

'Bill' Kunzmann Named V.-P. of S. M. P. E.

WILLIAM C. ("BILL") KUNZMANN was elected vice-president of the S. M. P. E. at the election of officers of the Society held on October 5 at the Hotel Pennsylvania, New York. Although desperate efforts were made to suppress the facts, the truth is that Bill Kunzmann has been associated with the motion picture industry for 27 years, all but two years of which period has been spent as a representative of National Carbon Co. It is estimated that during this time Bill Kunzmann has recited the merits of National Carbons to 56,427 projectionists (and operators), and as for sales—while Bill's sales are estimated as ranging all the way from 17,893,414,708 to 17,893,414,709 carbons. Statistics covering mileage covered by Bill during this period are now being compiled.

Bill was a theatre manager once, but he will have an easier time living this down than he will the fact that he was once a chief projectionist. Bill denies that "operators" are advanced to "chief's" in order to make the projection room a safe place in which to work.

Apart from these sins, Bill has led a blameless life. He knows more projectionists (and more about them), than any other living being, is the greatest convention organizer in the world, his interests are National in scope, and he has more friends in the picture business than any other National industry figure. Bill's friends are pleased at his election in the Society and have every right to expect a handout of cigars.

CODE REQUIREMENTS AND PROJECTION WORK

M. D. O'Brien

ASSISTANT DIRECTOR OF PROJECTION AND SOUND, LOEW'S THEATRES, INC.

This article reflects an official activity of the Projection Advisory Council

THE motion picture industry, after more than twenty-five years of growth, still suffers in one of its most important branches—projection—from the whims and fancies of small-town fathers. Every town and village throughout the country has spread on its records its own particular theory regarding the correct method of wiring buildings, and in no department are these local regulations more severe (I might correctly have said, silly), than in the theatre department.

Various town councilmen are thoroughly conversant with the best methods of constructing projection rooms (to hear them tell about it), and invariably the mayor's commitee reaches the conclusion that motion picture film should be enclosed in lead-lined caskets. Building departments have been known to lean toward the idea that there should be no openings larger than a penny slot machine slit in the front walls of projection rooms. There is hardly a town that doesn't pay some board or committee which attempts to regulate the construction, equipping and operation of motion picture theatres, according to its own preconceived notions of theatre design—be they of the vintage of 1895, 1903, or 1915.

This writer has found very few instances where any of these regulatory bodies has displayed good sense in seeking advice on such matters from those men who have spent the best parts of their lives working in or supervising the construction and operation of projection rooms.

A Truly National Body

There is one organization in existence today, the National Board of Fire Underwriters, which spends thousands of dollars annually in testing and approving materials and apparatus for use not only in theatres but in every type of building. This organization employs hundreds of men who are thoroughly familiar with every phase of electrical wiring, men who know through experience the proper fire preventive measures to be applied in any given instance. It is obligated to pass upon all equipment that is to be used in every type of building—industrial, commercial, public or private home—and to extend or withold its approval, depending upon the nature of its findings. This work, wide in scope and extremely thorough, is intended primarily to protect lives and property against any damage that might result from incorrectly designed electrical equipment or defective wiring.

Having functioned for many years in close cooperation with insurance companies, the National Board of Fire Underwriters has been able to save property owners millions of dollars annually through the medium of its National Code. This code covers every conceivable type of wiring and equipment, and its value has been recognized by more than half of the large cities throughout the country which have adopted it as official. Compiled by the best minds in American industrial life, this code has been a bulwark against defective equipment and improper wiring practices. It has been recommended by the National Fire Protective Association.

Apparently, this code should be sufficiently broad in scope to cover any type of electrical installation. There still are a few communities, however—yes, and even large representative cities—where it is deemed necessary to *improve* this National Code.

I should like to know why it is that these regulations, applicable to more than half the cities and towns in America, will not satisfactorily serve the entire country. Why must copper wire for a given purpose be larger in one city than in another? Why will a No. 000 wire suitably carry 175 amperes in one city and only 90 amperes in another? Surely the cross-sectional area of a copper conductor does not vary with a change in geographical location. If a ½" water pipe will carry sufficient water to supply a drinking fountain, why should it be necessary to install a 4" line?

Such inconsistency and lack of coordination between various cities and towns is very confusing and invariably expensive, particularly to an industry which is national in scope. We hold no grievance against that city which chooses to exercise local autonomy in the matter of building and electrical codes. But—why saddle unnecessary hardships on commercial organizations which will probably prove to be a decided asset to the community which they select for their new field of operation?

Comparative Wiring Data

In order to intelligently compute building costs, a contractor should be able to base his estimates on the materials required by a national code. But a contractor cannot provide his customers with accurate figures when several varieties of rulings are in effect. A city or town that requires the installation of larger and more expensive equipment than is specified in the National Code is putting a stumbling block in its own path of progress.

As an illustration of the comparative costs of wiring, there is appended hereto

N. Y. City Rejects New Building Code

PROJECTIONISTS should exercise extreme caution in lending credence to, and consider carefully the source of information before accepting, reports of "official" building codes which include provisions relating to projection room construction, equipping and operation. The current issue of a projection paper prints the projection section of a new building code now under consideration in New York City and intimates that its acceptance is a foregone conclusion. The publication in question also cites this proposed code as a model for other localities.

The fact is that this particular code has been rejected as unsuitable by the New York City government. Acting Mayor McKee is credited with the statement that "Under no circumstances will I sign this code in its present form." Projectionists should check carefully the source of all such advices, as misinformation of this sort can result in much harm to projection generally.

Table of Allowable Carrying Capacities of Wires

CITY CODE		NATIONAL CODE	
Amperes	Wire	Amperes	Wire
3	14 R. C.	3	1,624
5	12 R. C.	6	2,583
8	12 R. C.	15	4,107
10	10 R. C.	20	6,530
13	8 R. C.	25	10,380
19	8 R. C.	35	16,510
26	6 R. C.	50	26,250
32	4 R. C.	55	33,100
38	4 R. C.	70	41,740
45	2 R. C.	80	52,630
51	1 R. C.	90	66,370
64	0 R. C.	100	83,690
77	00 R. C.	125	105,500
90	000 R. C.	150	133,100
102	0000 R. C.	175	167,800
128	250,000 C. Mil.	200	200,000
141	300,000 C. Mil.	225	211,600
154	350,000 C. Mil.	250	250,000
166	350,000 C. Mil.	275	300,000
179	400,000 C. Mil.	300	350,000
192	500,000 C. Mil.	325	400,000
205	500,000 C. Mil.	400	500,000
218	500,000 C. Mil.	450	600,000
230	500,000 C. Mil.		
243	600,000 C. Mil.		
256	600,000 C. Mil.		

an extract from the code of a large city showing allowable current-carrying capacity of wires, together with a table bearing on the same point from the National Code. It will be noted that the latter permits the use of wire of a much smaller size and thus represents a considerable saving in wiring alone to the builder of large projects.

All cities and states should agree upon a uniform electrical code which would reflect the opinion of leading figures in electrical societies, engineering societies, telephone and electric light companies, fire insurance and rating bureaus, and other organizations of national scope which might have an interest in and be affected by such a code. Such a code is the National Electrical Code, which is sponsored by so many reputable organizations that it should suffice for any electrical installation.

Floor Covering

Then there is the matter of building and fire department regulations, of which there are so many variations that it is impossible for any company to standardize its operations over more than three states. The construction and equipping of a projection room will serve to illustrate this point.

The code of a certain state will not permit linoleum to be laid on a projection room floor—the same type linoleum, incidentally, that is being used on countless engine and fire room floors in some of the world's largest cities. This same state, however, permits rubber matting as a projection floor covering. By no stretch of the imagination can rubber matting be considered a fireproof material. Here the National Code reflects good judgment by ruling on neither rubber or linoleum, except as follows:

> "Wooden or other combustible flooring shall be secured to a floor of fireproof construction, except that a flooring of wood, linoleum, rubber, tile, or cork may be secured to a sub-floor of wood."

If linoleum were considered a fire hazard, it certainly would not be passed by the National Code for use in factories and public buildings. If a good grade of linoleum be installed properly by cementing to a floor, it is almost impossible to ignite it. Should a flame be applied to loose rubber matting, there is no doubt as to the outcome.

Projector Spacing

The variety of ordinances governing the construction of projection rooms would not be credited by those who are not really close to the subject. For instance, the code of one large city stipulates that "All motion picture machines shall be inclosed in a booth of fire-resistive construction not less than 8 feet wide (in the projection line); 8 feet long and 7 feet high for one machine; and for each additional moving picture machine, spotlight, stereopticon or similar device, add 5 feet to the length."

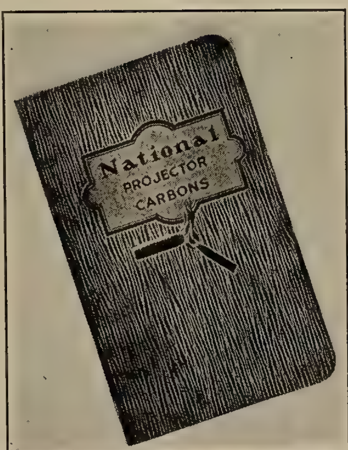
In some of our motion picture theatres employing stereopticons and spots, these regulations would require a room 43 feet in length. Now, while ample space certainly is to be desired, a stereopticon positioned some 20-odd feet off the center line of the theatre would produce some weird and unusual effects—effects not witihin the imagination of a majority of projectionists. It certainly is not practicable from the standpoint of showmanship to so design a projection room.

The National Code, on the other hand, treats the question of spacing projection equipment in the following intelligent manner (Sub-section 191, Article A of Section 19):

> "Motion picture projectors using nitro-cellulose film shall be operated or set up for operation only within an approved enclosure, not less than 48 square feet in size and 7 feet high. If more than one machine is to be operated, an additional 24 square feet shall be provided for each additional machine."

(To be Continued)

NEW NATIONAL CARBON HANDBOOK FOR PROJECTIONISTS



NATIONAL CARBON CO., INC., has just issued a new edition of its National Projector Carbon Handbook. The first edition of this Handbook represented the most complete and authoritative presentation of carbon data ever published and was widely distributed throughout the world. The current edition of the Handbook reflects the experience gained through publication of the first edition and contains up-to-the-minute carbon data, with particular emphasis having been placed on those points concerning projector carbon manufacture and operation which have elicited a majority of inquiries from projectionists.

The new Handbook runs to 98 pages and contains 58 illustrations. It covers in detail the various types and sizes of carbons for projection use and sets forth complete instructions for their proper use. Important operating precautions are discussed in the text, with all important points being clarified through accompanying illustrations. Particular stress is laid upon the difficulties encountered when carbons are not properly used and clear explanations of what to do to overcome these difficulties are offered. The book also contains a very interesting chapter on carbon brushes and their application to the various types of motors, generators, and converters used in connection with projection equipment.

A copy of this new Handbook may be obtained without charge by all readers of INTERNATIONAL PROJECTIONIST. Address your request to National Carbon Co., Inc., Carbon Sales Division, P. O. Box 400, Cleveland, Ohio. Projectionists should include in their letters the name of the theatre in which they are employed.

***The introduction of new equipment designed to effect a substantial extension of the frequency range has precipitated a number of interesting discussions, not the least of which is the accompanying symposium which includes a letter to the editor and two replies thereto. Presentations such as this, which involve sharp differences of opinion, almost invariably result in the projection in sharp relief of the points under consideration. And so it is in this instance, with the information being presented in such interesting form as to demand the close attention of every reader.*—Editor.**

A Letter to the Editor

SIR: Regarding the August issue of INTERNATIONAL PROJECTIONIST the first subject, "Recent Improvements in Sound Systems", by "The Onlooker", reads like a catalog instead of information for the projectionist. It is evident that "The Onlooker" believes everything that ERPI claims.

There never was an amplifier, new or old, capable of reproducing sound from 100 cycles to 5,000 cycles. It is true that sound can be secured from a unit at 5,000 cycles, but the gain would be increased to such a degree that at 2,000 cycles the volume would be terrifflc; in other words, the curve of the unit would look just as crooked as a curve of almost any good amplifier. By this I mean that the curve of any amplifier used in a theatre is very poor from zero to 150 cycles, and rotten from 4,000 cycles up.

Changing a transformer, or the addition or removal of a condensor or a resistance will not increase its range, that is, give it a flat curve—the kind ERPI would like to have one think its amplifiers have. The little Tin Horn of ERPI's may be a help in reproducing higher frequencies, if they really have straightened the corkscrew curve of their amplifier. The little dynamic speaker in a big horn will build up the lows some. But the recording has a very poor curve at about the same frequencies as have the amplifiers. Most of this trouble is due to the "mike", and the moving coil is not much help.

It would be interesting to see a curve (that is, an actual curve and not the pretty one they put in the catalogs), of a track recorded with the new ERPI equipment, and also a curve of the new amplifier. Of course, the speaker units would not be included in this curve, as that is still another curve.

Some months ago I had a look at the "Tin Horn" and the mike". It looks to me as though the producers are being taken for so much more of the $$$$, even if this new equipment is good or just a little bit better, if any. I can't see why the added weight of a coil to the diaphragm of a "mike" will help in getting a wider range of frequencies.

"The Outlooker"

REFINEMENTS AFFECTING THE FREQUENCY RANGE

By "The Onlooker"

(Aaron Nadell)

IT is irrelevant, no doubt, but I cannot help wondering about the motives of your correspondent, "The Outlooker", in writing the letter that he did. I present here a few elementary refutations of some of his most glaring mis-statements. Many more similar references are available, but it seems to me that the only open question about this whole matter is the one bearing on how much time one has to spend in finding authoritative statements that 2 and 2 are 4, and that green isn't blue.

It appears that by concentrating my reply on the most obvious errors in the statement by "The Outlooker" we all shall be able speedily to reach certain definite conclusions. Our first consideration shall be the statement that:

> "I can't see why the added weight of a coil to the diaphragm of a 'mike' will help in getting a wider range of frequencies."

The moving coil microphone is discussed in the December, 1931, issue of the *Journal* of the S.M.P.E., page 977, *et seq.* The condenser and carbon types of microphones are described in the January, 1931, issue of the same *Journal*, page 3, *et. seq.* It is not necessary even to read these papers to discover that these three types of microphone are three different and distinctive devices: the photographs or line drawings showing the construction of each will make that clear to the least technical reader. The papers describe the construction of each, the principle on which each operates, and their relative advantages and disadvantages.

Types of Microphones

As a brief summary, which I should be glad to have checked by the text of those articles: the carbon microphone operates on the principle that pressure, when applied to a mass of carbon particles, decreases the electrical resistance of that mass. If such a mass of particles is packed behind a diaphragm free to vibrate, a current passing through them will vary in strength according to the vibrations imparted to the diaphragm. The carbon microphone is therefore not a generator; its action is in the nature of that of a valve.

The condenser transmitter consists of a charged condenser, one plate of which is free to vibrate. The capacitance of any condenser depends, among other things, upon the spacing of its plates. If one plate vibrates, the condenser will charge (assuming a source of current is connected with it), when the plates move together, and will release a portion of its charge when the plates move apart. In this sense the condenser microphone acts as a generator, since it converts the direct current with which it is charged into alternating current created by its alternate charge and discharge whenever the free plate vibrates.

The moving coil microphone is a pure generator, creating current, as a dynamo

does, through the motion of a conductor in a magnetic field. Its action is identical in principle with that of the disc reproducer, the only difference being that air vibrations actuate the microphone, and needle vibrations serve the same purpose in the reproducer. The moving coil microphone is a loud speaker working backwards — any "dynamic" speaker will act as a "mike" providing the sound vibrations it is asked to pick up are strong enough to move its heavy diaphragm.

The purpose of the moving coil mike is *not* to get "a wider range of frequencies" but to escape the "hiss" of the carbon and the bulkiness, inefficiency and short-distance pick-up of the condenser type. [*Editor's Note:* It appears that Mr. Nadell is over-emphasizing the importance of carbon "hiss", the ill effects of which in motion picture production work have been largely overcome, if not eliminated.]

Wide Range; Flat Curves

The foregoing is substantially an accurate summary of the facts to be found in the articles I mentioned previously, and seem to me, at least, to constitute conclusive proof that "The Outlooker" permitted himself the luxury of positive statements without sufficient investigation as to their merits. Another statement by "The Outlooker" is:

> "Changing a transformer, or the addition or removal of a condenser or resistance will not increase its (amplifier's) range—that is, give it a flat curve. . . ."

In "The Theory of Thermionic Vacuum Tube Circuits," by Leo James Peters, assistant professor of Electrical Engineering at the University of Wisconsin, published by McGraw-Hill at New York, 1927, page 288 of the 1st edition, I find:

> "For the circuit under discussion, if we are interested in flattening out the amplification curve up to 5,000 cycles per second a resistance of about 250,000 ohms should be placed across the secondary of each transformer. The value of 250,000 is given because the input impedance of the tubes at 5,000 cycles is about 400,000 ohms. . . . if the net impedance across the secondaries of the transformers is to be substantially a pure resistance at *all* frequencies (italics mine), the resistance used must be somewhat lower than the input impedance of the tubes at the highest frequency considered."

The gist of this is that addition of a resistance *will* flatten the curve of an amplifier, and that the extent of the flat portion of the curve will depend upon the value chosen for the resistance.

As for transformers and condensers, the handiest authority I ran across in my brief search was "Principles of Radio Communication", by John H. Morecroft, Professor of Electrical Engineering at Columbia University, Past President of the Institute of Radio Engineers, John Wiley and Sons, Inc., New York, 1927, 2nd edition. Page 912 *et seq.*, discuss the design of voice-frequency transformers, and the choice of various designs according to the curve desired; page 918 shows curves of half a dozen such transformers of varying degrees of flatness. Page 949 discusses the choice of optimum values of coupling condensers and resistances in resistance-coupled amplifiers. Detailed quotation would make for intolerable length; the book is available everywhere and I refer you to it.

As to "The Outlooker's" comment on Erpi's curves, I could reply by saying I have made some runs on Erpi equipment myself, but that would be merely a matter of my word against his. The essence of the matter is that their published curves have shown regular and natural improvement in characteristics over a period of years, and that, having been printed by reputable engineering societies, those curves are entitled to be regarded as "accepted" by the profession.

In order to go beyond that, I think it would be fair to ask "The Outlooker" upon what grounds or evidence (unknown to the rest of us) he bases his challenge. Until the gentleman comes forward with that information, or with some other evidence in support of his blank assertion—evidence that can be examined and analyzed—I don't see how I can go beyond my own small experience in making gain runs and the apparently unanimous acceptance of the engineering profession. Or why I should have to?

Addendum

Engineering Dept., Electrical Research Products Co.

IN answering the questions raised in a letter received by INTERNATIONAL PROJECTIONIST regarding the article in the August issue of that publication signed by "The Onlooker", it is advisable to give a connected statement of the facts as they exist rather than to attempt a detailed discussion of the material contained in the letter. As a preliminary to indicating progress, it might be wise to digress for a few moments and discuss briefly the methods of test by which we determine progress.

The most commonly known test is the response versus frequency or pitch. Such calibrations can be made for microphones and other forms of pick-up, for amplifiers and for loud speakers. Such tests can be made under any desired electrical circuit condition. The circuit conditions of interest here, however, are those which apply to the apparatus as it is actually used commercially, since the resulting sound which is heard is obtained under these conditions.

Conditions of Measurement

The conditions of amplifier measurement will be chosen as typical and will be outlined in some detail. To measure the gain-frequency characteristic of an amplifier, it is necessary to measure the ratio of the power drawn from the output terminals to the power delivered to the amplifier input. The gain-frequency curve will have a shape which depends on the characteristics of the amplifier itself and also on the electric characteristics of the input circuit and of the output circuit. It is necessary, therefore, that the measurements for practical purposes can be made with input circuits and output circuits having characteristics which are the same as those connected with the amplifiers in its practical conditions of use, or with circuits whose effects are translatable into the terms of practical operating conditions.

All of the curves which have been published through ERPI have been taken under these conditions and therefore represent the performance of the equipment under *actual operating conditions.*

There are two common means of expressing the results of such tests. The first consists in plotting the ratio of output energy directly against frequency; the other is to plot this in terms of the logarithmic unit, the decibel, against frequency. All of the ERPI curves are expressed in this latter unit, since this unit is the only simple one in common use which closely approximates the ear's interpretation of intensity. This whole matter is discussed in some detail by Dr.

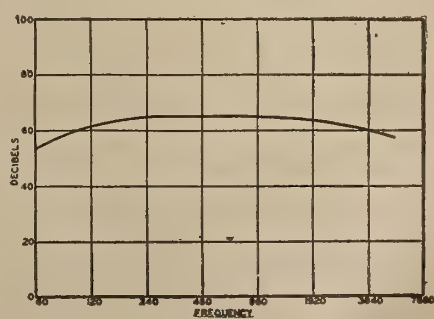


Fig. 1. Public address system amplifiers

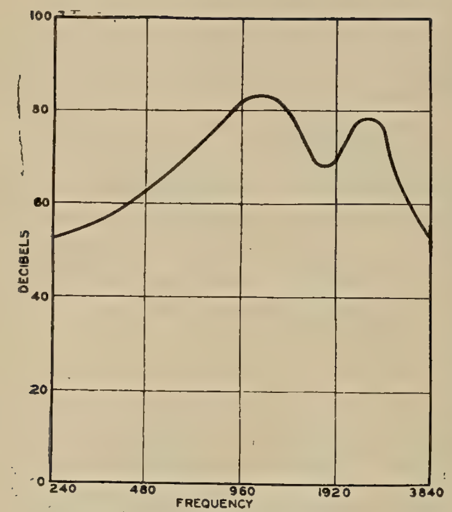


Fig. 2. *Complete public address system with carbon transmitter*

Harvey Fletcher in his book *Speech and Hearing.*

We will now return to a discussion of the progress which has been made during the last nine years. Figure 1 shows the frequency characteristic, expressed in decibels, of the amplifiers commercially in use in the Western Electric public address system in 1923. This curve has been copied from a paper by I. W. Green and J. P. Maxfield, entitled "Public Address Systems" and published in the *Journal* of the American Institute of Electrical Engineers, and the *Bell System Technical Journal,* both of April 1923.

When it is remembered that the ordinary sounds reproduced in a theatre are 70 or more db. above minimum audibility, it will be seen that the droop of the amplifier between 60 and 1,000 cycles and again between 1,000 cycles and 4,000 cycles is relatively small and would produce very little damage were this distortion the only error in the system. Figure 2 shows a calibration of the complete public address system including the carbon transmitter and loud speakers then available.

We now come forward three years and find in the *Journal* of the American Institute of Electrical Engineers for March, 1926, a paper entitled "Methods of High Quality Recording and Reproducing of Music and Speech". This article shows marked improvement both in flatness of the response curves and in their range, the pickup and amplifier equipment being essentially flat from 50 to slightly above 5,000 cycles per second.

A similar history of improvement can be found in connection with the loudspeaker and the microphone. Figure 3 shows the calibration of the present moving coil or dynamic microphone measured from the sound pressure in the air to the electrical circuit. The electric circuit was so terminated that the calibration indicates the input supplied by this microphone to the amplifier. Figure 4 shows a response frequency characteristic in the W.E. 555-W and 15-A horn.

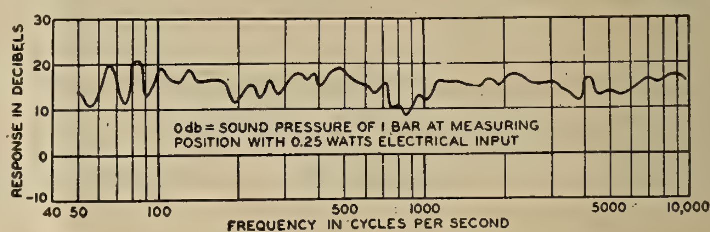
Recent Speaker Developments

The final form which the loudspeaker will take in the theatre in all probability will be of the character demonstrated recently to the Society of Motion Picture Engineers. Calibration of this loudspeaker is shown in Figure 5, from a paper entitled "Recent Fundamental Advances in Mechanical Records on Wax" by H. A. Frederick, published in the *Journal* of the S.M.P.E., February 1932. This type of speaker consists of a combination of two units: one to handle frequencies below 3,000 and the other to handle frequencies above 3,000.

This article by Mr. Frederick is of considerable interest since it shows a large number of calibration curves of the various parts of the equipment and also some curves showing the calibration of combinations of the equipment.

Question has sometimes been raised regarding the value of "Wide Range" from the point of view of the theatre and the amusement of the public. You might be interested in what Mr. Leopold Stokowski, Director of the Philadelphia Orchestra has to say in this connection.

Fig. 5. *Response frequency characteristic of combined high and low frequency loud speakers*



The following quotation is from an address which he delivered before the New York section of the Society of Motion Picture Engineers, and the whole of the paper can be found in the *Journal* of that Society for February 1932. The quotation is:

"That suggestive power which can carry us into the most remote spheres and realms of feeling and thought, and things that are higher than thought and higher than feeling—that is the important part of music. And in order for this to be done we must have this greater range which we have had demonstrated here tonight; greater range of frequency, of volume, and the elimination of foreign noises, needle scratch, static, and all the noises that we hear in radio. You hear on your radio the dial telephone in the next room; you hear the refrigerator; you can hear all the vegetables in the refrigerator talking to each other; and when the cook takes them out of the refrigerator and puts them on the electric stove and switches it on, you hear that. And so it goes. We must find methods of eliminating all foreign sounds.

Wide Range Desirable

"When our orchestra plays in Philadelphia, or as we played last night at Carnegie Hall, here in New York, we give out a volume range of about 75 db.; but when we are recording we do so at about 35 db. And I think it is important for everyone connected with music, and the public at large, to know definitely and quite clearly—it is no secret, but quite plain—that when they listen to a record, or when they listen to a radio, they are listening to a sound level of approximately 35 db., sometimes less, sometimes a little more. But when they listen to a symphony orchestra, which is, I think you will agree, the most difficult thing to record or to transmit, they are listening to a level of about 75. We

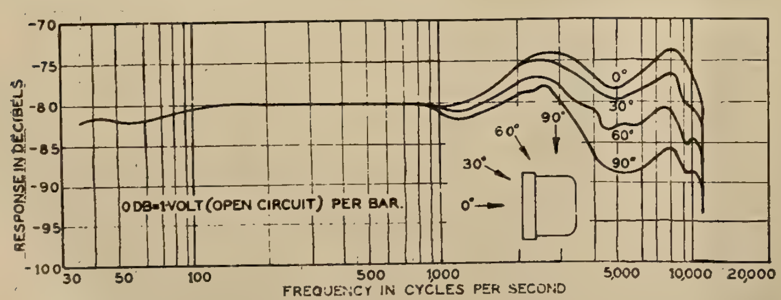


Fig. 3. *Field calibrations of the 618-A moving coil microphone, showing the effect of the angle of incidence of the sound wave*

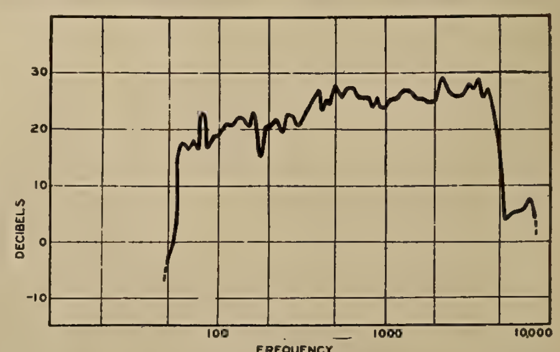


Fig. 4. *Response-frequency characteristic of 57-cycle cut-off exponential horn and 555-W receiver*

must find a way of increasing that 35 to 75 before we really can give the public what it ought to have in the way of expression in music.

"That is one dimension, so to speak. Then there is the other dimension, the up-and-down dimension, the frequency range. When we play as we did last night at Carnegie Hall, in the overtones, or in the fundamentals, we are producing frequencies certainly up to 13,000, probably more. But we know certainly that it is up to 13,000. When you hear a record or when you hear music over the radio, you are hearing frequencies of about 4,500, often less, sometimes a little more. The average, however, is about that."

It would seem that in view of the fact that the reputable engineering societies had seen fit to accept these papers over a period of some nine years that the facts laid down in them have not been seriously questioned by the engineering profession.

LANDMARKS AND PENNIES

Modern knowledge of disease is the combination of many different discoveries which often established landmarks in medical progress. Tuberculosis is used as an example.

H. E. Kleinschmidt, M.D.

Each year at this time it is the pleasure of INTERNATIONAL PROJECTIONIST *to include in its columns editorial and advertising matter prepared by the National Tuberculosis Association in its drive to spur the sale of Christmas Seals. These seals, small in size, exert a mighty power in helping to rid the world of the scourge of tuberculosis. It should not be necessary to remind projectionists as a craft of their debt to the National Tuberculosis Association, whose splendid work has meant happiness to many projectionists. This year it is more important than ever that projectionists further the work of the Association by buying Christmas Seals. Buy to the limit.*—Editor.

AGES ago, someone used a forked stick to plough up the ground. From that humble beginning has developed the modern gang plow, which cuts up into beautiful geometric furrows hundreds of acres in a day. Not the masterpiece of a single mind is this extraordinary tool, but the gradual development of many minds.

The medical science we have today has been similarly won by adding bit upon bit of knowledge. Consider, for example, a single aspect of medical knowledge, namely, the contagiousness of tuberculosis. The ancients knew about this disease. Four centuries before Christ, Hippocrates, the Greek physician, described the appearance of a dying consumptive so graphically that it serves as an accurate picture today. But he had no clear idea as to how this disease is acquired. For some 17 centries after Hippocrates, little genuine knowledge was added. All sorts of influences, from demons to night air, were accused as the cause of consumption. A favorite explanation was that the disease was inherited.

Almost two more centuries passed before the communicability of tuberculosis from one person to another was proved. That was done by Villemin, a French doctor, in 1865. Working in city slums, stables, slaughter houses, and in the laboratory with animals, he became convinced that consumption is caused by an invisible poison, though he had no idea what this might be. Twelve years later Tippeiner produced tuberculosis in dogs by causing them to inhale dried sputum from persons who had the disease. A number of other workers succeeded in producing the disease in animals by feeding them the milk of tuberculosis cows.

To Pasteur, whom France gave to the world, is due the honor of having discovered that minute forms of life called bacteria cause the so-called communicable diseases. Some day, he said, even consumption would prove to be a germ disease, and that started numerous scientists on the trail of the cause.

The Work of Robert Koch

One of the searchers inspired by Pasteur was Robert Koch, who became interested in germs while still a young practitioner, laboring alone in an obscure Prussian village. Later when he was put to work in a fine laboratory maintained by the German government, he made his famous discovery that the tubercle bacillus is the sole direct cause of tuberculosis. His discovery was not a lucky guess, but the firm establishment of fact, built up step by step. To put it briefly, Koch proved these things:

1. That a germ he called tubercle bacillus is found in the bodies of persons and animals sick with tuberculosis.
2. That this germ can be grown artificially in pure cultures.
3. That the germs from the pure cultures, when injected into the lungs of animals, cause tuberculosis.
4. That the identical germs can again be found in the bodies of such animals.

So thorough was Koch's work and so complete his proof that the modern campaign to combat tuberculosis is still based on the fact that "tuberculosis causes tuberculosis" and that its spread can be stopped by preventing the tubercle bacillus from getting from the lung of a sick person to that of a well person.

Koch's discovery led people to fear that tubercle bacilli were all about them and that escape was well nigh impossible. Cornet, in 1888, emphasized that these germs are not "everywhere" but are found chiefly in the sputum of the consumptive. He taught that the germs must be destroyed, and that this was best done by burning the sputum. He warned against the use of the common drinking cup, careless spitting, coughing and sneezing.

Theobald Smith, an American, proved in 1898 that there are at least two types or families of tubercle bacilli. The bovine type causes the disease in cows; the human type in man. Later he and other workers proved beyond a doubt that the bovine type of tubercle bacillus may also cause the disease in man. This is one of the most important reasons for pasteurizing milk.

Soon after Koch announced his discovery it was learned that a great majority of adults have a little tuberculosis but are never aware of it. How could one have this disease and not be sick? was the question. An Austrian, Pirquet, devised a tuberculin test which could be applied safely and easily and which would indicate those persons in whose bodies tubercle baccilli had found lodgment. Many studies made with this test showed that a great number of people sooner or later become infected with the germ but never develop the disease. It was found that among very young children only a very few are infected but that as the years pass, more and more become infected. This knowledge has done much to protect children from being exposed to massive doses of tubercle bacilli and to protect those already severely infected against such influences as favor the development of the infection into disease.

Others have added their bits of knowledge so that today we can make with assurance certain statements about how tuberculosis spreads. Intelligent application of this accumulated knowledge would ultimately make tuberculosis a rare disease.

> We know that the tubercle bacillus is the direct cause of tuberculosis.
>
> We know that it is common for the germ to infect young children; that the disease may remain dormant in their bodies for years but that the disaster of disease may be avoided.
>
> We know that children reared in homes where there is a case of tuberculosis are in particular danger, but also we know how to protect them.
>
> We are certain that "tuberculosis causes tuberculosis" and that finding every hidden case is the first step in preventing the spread of the disease.

This is the knowledge that the 2,084 affiliated tuberculosis associations throughout the United States strive to impress upon the public by means of all-year-round educational work. At the

VIBRATION-ISOLATION PROBLEMS IN PROJECTION

A PREVIOUS article[1] on vibration as an enemy of good picture and sound projection dealt with the necessity and means of effectively isolating the motor-generator sets and in some cases the projectors themselves. The isolation treatments described involved the use of "Keldur," a synthetic rubber-like material having a high "damping" factor.

Vibrations from one source are as bad as those from another, and those set up by a blower or fan or pump or refrigerating compressor are just as much a bane of clear reproduction as those emanating from a motor-generating set; indeed more so, as the latter is a much better balanced piece of equipment than the others mentioned. The projectionist's vibration worries, therefore, reach out into all parts of the theatre to those items of motor-driven mechanical equipment which are outside of his domain and his jurisdiction.

In the accompanying figures are shown the details of isolation treatments of typical units to be found in the average theatre. Figure 1 covers the isolation of a typical blower forming a part of the usual air-conditioning system, the blower and motor being on an integral concrete slab base, the latter "floating" free on a single perforated layer of "Keldur." No side bracing or anchor bolts are used, the surface friction of the upper and lower concrete surfaces against the "*Keldur*" serving to prevent any displacement of the equipment.

Canvas connections are, of course, used to join the blower outlet to the duct carrying the air into the system. The above method will serve for the isolation of blowers and pumps, whether V-belt driven or direct-connected.

It is sometimes necessary to isolate a driving motor separately, as in the case of existing installations of large slow-speed ventilating fans, where we have a fan of large diameter set in a wall opening, belt-driven by a motor set on the floor beneath. In such a case, the problem involves the elimination of transmission of any vibration from the motor into the floor, while at the same time holding the motor in place against the requisite belt tension.

Figure 2 shows one method of accomplishing this efficiently; it will be noted that there is no continuous metallic circuit from the motor base to the floor through which the vibrations can find their way.

All departments in a theatre organization are equally and vitally interested in clarity and quality of reproduction as major factors in the growth of house popularity among the public, and in the general interest it therefore behooves construction and engineering divisions to extend maximum cooperation to the projection departments by effectively isolating all mechanical equipment in the building, thus eliminating *at the source* all vibrations which otherwise cannot but be detrimental.

Projectionists as a group appreciate these specialized problems of their work, and this being so, it would be well if construction and mechanical engineers enlisted the aid of the man in the projection room in solving all specialized problems of projection work, including vibration elimination.

[1] "Vibration: Relentless Enemy of Good Projection," by R. G. Hess, INTERNATIONAL PROJECTIONIST, July, 1932, Vol. 3, No. 1.

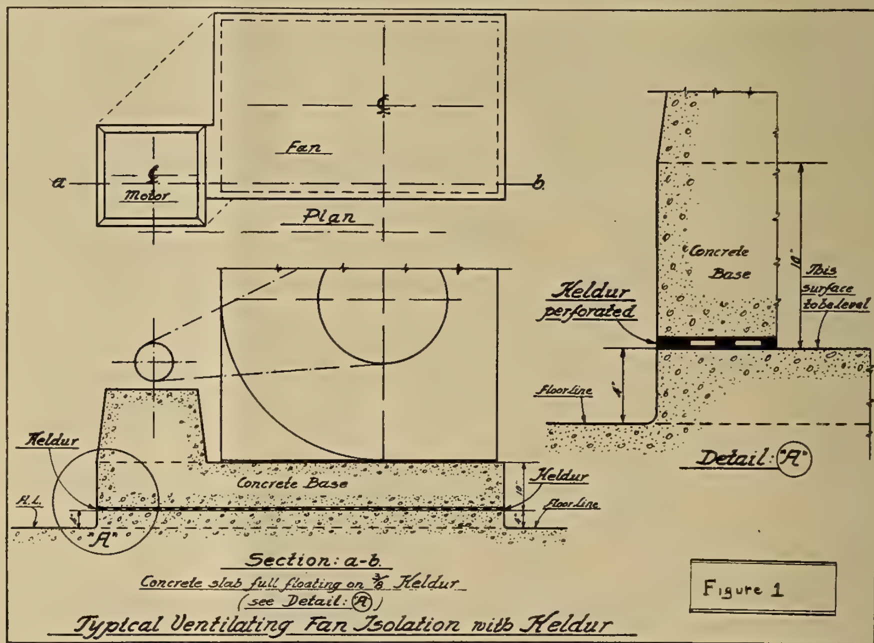


Figure 1

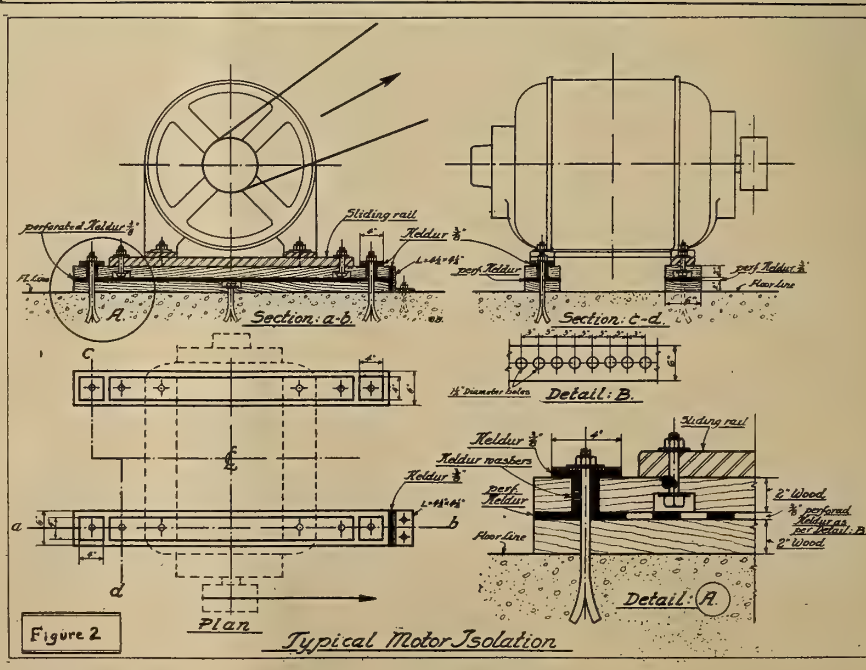


Figure 2

LANDMARKS AND PENNIES

(Continued from preceding page)

same time they fight the disease directly by promoting free clinics for diagnosis, nursing service to care for those who have the disease, and preventoria to build up the strength of children who are below par physically and are thus potential victims of tuberculosis.

Any interruption of this work is a threat to the health, happiness and security of all. The funds that maintain it are obtained by the sale of penny Christmas seals each year between Thanksgiving and Christmas.

THE P. A. C. : ITS WORK AND ITS CRITICS

Thad C. Barrows

PRESIDENT, PROJECTION ADVISORY COUNCIL

DURING the twenty-five years that I have been a practicing projectionist I have witnessed many attempts to effect the organization of a purely projectionist society that would serve the projectionist in the way that organizations in other fields serve similar groups of craftsmen. There have been two organizations to date that have rendered a real service to projectionists: the American Projection Society and, later, the Projection Advisory Council.

I am reminded of these and other matters by reading in the October issue of *Motion Picture Projectionist* an article, to which is attached the signature of Karl Fuller, headed, "Needed: A Society for Projectionists." Three things regarding this article remain fixed in my mind, and these are: (1) the story is strongly reminiscent; (2) it contains many mis-statements of fact, and (3) it reflects poor judgment by the managing editor of a publication purporting to serve projectionists. I shall discuss these three points in order.

Mr. Fuller's article is similar tn theme, heading and treatment to an article entitled "Wanted: A National Society of Projectionists," by James J. Finn, which appeared in the February, 1932, issue of INTERNATIONAL PROJECTIONIST—an article which I discussed in the issue immediately following.[1] Frankly, the article by Mr. Fuller impresses me as being merely a re-hash of the material presented in the two earlier articles I mention, with certain additions which I shall discuss shortly.

Mis-statements of Facts

My objection to Mr. Fuller's article is based on the numerous mis-statements of fact contained therein. It is charged that the Projection Advisory Council failed because it was never clear as to intent and direction. The intent of the Council is set forth in the very first section of its articles of incorporation (if Mr. Fuller ever took the trouble to read these articles, which have been widely publicized); and if these articles are not sufficiently clear, I shall add that the Council's intent is that which is implied by its title: a body of projectionists which, ignoring politics and purely labor organization matters, would consider carefully all problems affecting the general welfare of the projectionist, whether relating to better working conditions, safety measures, improved technique or general craft morale. The Council also is concerned with seeing to it that the projectionist receives favorable publicity whenever and wherever possible; but it does not in even a single instance attempt to explain away any deficiency of a projectionist.

Can Mr. Fuller honestly say that any organization within this industry possesses regulatory powers? Even the Academy, with producer backing? Or the S. M. P. E., which certainly has attracted many of the so-called "best minds" of the technical branches of the industry? Or the Hays organization? An honest answer to these queries must be "No." Why, then, single out the Council for the distinction of being nothing more than an advisory body?

Mr. Fuller states that the Council lacks able direction. Considering the difficulties under which the Council operates, I must say that its direction is something more than adequate; it is marvelous, considering the paltry sum of money available and the difficulties of operation offered by a widely scattered membership. Perhaps Mr. Fuller will explain in detail just how representatives of various cities and towns may be brought together in convention, fares and hotel expenses considered.

"Publicity-seeking" is the term that expresses another of Mr. Fuller's peeves against the Council. We Council members admit this "charge." What about it? Every organization that ever existed depended in large measure on favorable publicity. In fact, both the S. M. P. E. and the Academy have publicity committees. So has every producer, every so-called de-luxe theatre. Of course, I understand that Mr. Fuller had in mind the

Thad Barrows

charge that the Council concentrated on publicity work to the exclusion of other worth while activities. If this be so, Mr. Fuller is sadly mistaken. More later on this topic. It will suffice to say at this point that publicity was a vital necessity to the Council in its formative stage. (It is now only 2½ years old.)

Use of Prominent Names

Another statement by Mr. Fuller reads: "It (the Council) was a paper organization from the start. Although some projectionists allowed their names to be used as members of committees and officials, very little work was done and nothing was accomplished." This statement is wholly untrue.

The Council lists among its officers and committee heads men who are admittedly the "cream" of the projection profession. *All* of these men were *elected*, not picked at random, and all are paid-up members of the Council. I list a majority of officers and committee heads:

Lester Isaac	Chauncey Greene
Sidney Burton	Charles Eichhorn
Larry Katz	Ted Eckerson
Harry Rubin	William Roberts
Larry Jones	Victor Welman
Ed Keller	R. Miehling
Frank Sutton	C. Dentlebeck
Jesse Hopkins	V. Armand
R. H. McCullough	F. H. Richardson
J. R. Cameron	James J. Finn
George Edwards	Tom Reed
M. D. O'Brien	Otto Kafka
Hirsch Stein	Ben Stern
Lester Bowen	W. C. Ricks
George A. Yager	C. E. Curle

The Council includes many more splendid craftsmen, who served as officers or committee heads. Every one of the fore-

[1] "An Open Letter to James J. Finn," INTERNATIONAL PROJECTIONIST, March, 1932, Vol. 2, No. 1.

going is a paid-up member. So much for this charge.

It is said by Mr. Fuller that the Council was a "paper organization" and is now "dead." This is news to me. Only last week certain conferences were held with responsible I. A. officials, in accordance with the action of the last meeting of the Council, which bears every promise of securing the *official indorsement* of the International Alliance for the Council *as an organization.* The Alliance, I expect, will do more than merely endorse the Council; it will render active support in all Council activities. What does Mr. Fuller think about this? There is no need for uttering pious hopes for the revival of the Council. It is far from dead, and in fact has not even been ailing.

Now let us see just what the Council has accomplished, in order to prove or disprove Mr. Fuller's statement that it is a "paper organization."

The Council put over the Standard Release Print in the field. The Academy acknowledges this fact. Mr. Irving Thalberg still is wondering about the splendid job that was done in the field—the first cooperative effort of its kind ever to succeed in the projection field. The Council was active in this work from the start, when the industry first began to think about the S. R. P. How about it, Mr. Fuller?

The Council rendered yeoman service in the establishment of the Uniform Aperture. It was the Technical Coordination Committee of the Council that fought the first proposals on the Uniform Aperture, proposals which invited disaster to a large majority of theatres in this country and throughout the world.

Current Council Activities

It was a Council committee composed of Harry Rubin, P. A. McGuire, Herbert Griffin, and James J. Finn that met in New York City on a certain Friday night just about one year ago that gave voice to the first objections to the then generally accepted aperture dimensions. In addition, frequent conferences between this writer and members of this committee, and a representative of the Academy, finally established a working basis on the aperture matter. Also, it was a Council member, Mr. Harry Rubin, who, acting on the results of the meeting of the Council committee, carried the fight to the floor of the S. M. P. E. meeting of various committees and recited the projectionist objection to the proposed aperture standards. How about this, Mr. Fuller?

It was the Council that first formulated effective projection room plans, the contribution of M. D. O'Brien, of Loew's Theatres, Inc. (working as a Council member and on a strictly Council activity), being published in various periodicals having a combined circulation of more than 650,000. It was George A. Yager, Business Agent of Local 250, Salt Lake City, who, working as a Council committee head, formulated data on projection room fires that has been distributed to more than 200 Local Unions of the I. A., in addition to being used in many daily newspapers throughout the country. How about this, Mr. Fuller?

Many Local Unions of the I. A. used data compiled by the Council in radio talks in their districts, notably Local Union 306 of New York City. It was due to the Council that plans on the new Pennsylvania State Building in Harrisburg were changed to conform with accepted projection room practice and equipping. How about this, Mr. Fuller?

Since January 1, 1932, the Projection

PREPARING FOR THE FUTURE MEANS TAKING STOCK NOW

Chauncey Greene

MEMBER, LOCAL UNION 219, MINNEAPOLIS, MINN.

DR. GEORGE A. DORSEY, who the writer sincerely hopes is a learned scholar, has written a book entitled, "Why We Behave Like Human Beings." The basic theory underlying *why* we act like human beings (in our rational, and therefore strange, interludes), is doubtless interesting, but the practical man can seldom be induced to delve deeply into the fundamentals, preferring rather to view the net result, fix it in his memory, and be off on the trail of another net result.

Let us assume, then, that we do act like human beings. One of the common failings of all of us humans is to think that the present situation, whatever it may at the moment be, will continue indefinitely. We thought so about the silent days, even after we had seen and heard DeForest's Phonofilm. We thought so about Anaconda Copper and Warner Brothers and Cities Service in 1929. We are prone to think so about the present state of our own industry, wherein the exhibitor, himself a human being (for confirmation send a stamped self-addressed envelope to Ripley), is in the well-known rut and his vocabulary is limited to one word, "Cut," with the fader way up until one longs to be his barber just once.

Quality Means Nothing

Excellence of performance means absolutely nothing. If the picture is a jumping-jack and ten cents will steady it, "Let it jump," says the exhib., unless someone else will spend the brace of nickles. If Norma Shearer sounds like a St. Bernard snoring in a cistern, what cares the exhibitor? He's saving money. Oh, Yeah?

But let us not delude ourselves into thinking that this state of affairs is to last forever. Already the warnings are coming through in the form of occasional extended range recordings. These, of course, sound little better than the old recordings when played over our present channels, but make no mistake, one of these days some smart exhib. (there must be *one* left), in your community, having played successively if not successfully with the bulls, the bears, and the jackasses, will suddenly get an idea to attend to business and make the necessary changes in his channels. The public will react, let us not be fooled about that either, unless the exhibitor is chump enough to try to combine high-fidelity sound with low-fidelity projection. The competition will wake up, exchange its bellyache for a headache, commence to wonder what it's all about (will never find out, of course; if it did the shock would be fatal) and another typical stampede for which this cockeyed industry is famous will get under way. Those who prepare will profit.

Taking Stock of Ourselves

Years ago a friend of the writer was preparing to forsake the ancestral acreage for the big city. Naturally he received a great deal of advice from the local sages, but one old Swede contributed the gem when he said, "Now Yens, ven you get to de big city remember yust two tang. Look dumb and be smart." At the present time, with industry at a standstill, we see many of the public service corporations engaged in reorganizing, rebuilding, and in some cases expanding. It *looks* dumb, but maybe they are being smart. They are getting their buildings and facilities now for a fraction of their cost ten years hence, and when they need them they will have them.

Perhaps now would be a very good time for the projectionist to take inventory, overhaul and reorganize. We might find a surprising amount of deterioration. Replacements and additions to our stock of knowledge and skill will cost much less now than they will later when the need for them will be more acutely felt than at present, and when we suddenly do need them we will have them.

Look dumb—but be smart!

Advisory Council has supplied the following information to the number of Local Unions indicated:

16—Fire Prevention
9—Safety and Ventilation
6—Radio Talks

This, in addition to much routine work in connection with both the Uniform Aperture and the S. R. P. At present, additions are being made to the room planning recommendations in order to bring them up to date; a series of articles on fire prevention has appeared in International Projectionist (strictly a Council activity), and M. D. O'Brien is compiling data on the various code requirements. How about this, Mr. Fuller? The Council is doing other work which it does not seek to have broadcast in the industry press. Understand, Mr. Fuller?

All this work is being done on nothing —nothing—as the Council is not now asking dues from its membership. If this be not a labor of love, Mr. Fuller, and in line with the best traditions of high-purpose organizations, what else is it? So much for Council activity.

S. M. P. E. Affiliation

The third point I have in mind regarding Mr. Fuller's article concerns the implication that projectionists might well affiliate with the S. M. P. E., what with the Council being "dead." Any projectionist publication which prints such a suggestion certainly cannot be considered to have the projectionist's interests at heart. For Mr. Fuller's information, I will state that if the S. M. P. E. lowered its entrance fee to $2 and its yearly fee to $1.50, it would get so few projectionist members as to make its efforts a waste of time.

The S. M. P. E. cannot by any stretch of the imagination be regarded as a projectionist organization. In one breath Mr. Fuller cites the need for a projectionist organization; and immediately thereafter he advises affiliation with the S. M. P. E.—providing the Society creates a new class and lowers its charges. I wish Mr. Fuller would explain just what it is that the S. M. P. E. has to offer projectionists generally, either in its meetings or in its Journal. Representation of leading projectionists on several S. M. P. E. committees is desirable, just as much for the benefit of the Society as for the benefit of the projectionist craft. But until Mr. Fuller, or someone else equally able, can explain just what the Society has to offer projectionists, I shall adhere to my present opinions in this matter.

It certainly seems strange that a projectionist publication should permit the use of its pages for the promotion of the S. M. P. E. at the expense of purely projectionist organizations.

Non-support is the reason why the Council has been unable to expand its activities. Here and there we find a few earnest, sincere and hard-working men who are willing to contribute their services to the common good. Very few. The rank and file of the projectionist craft are content to sit back and take whatever is placed in their laps. The same condition helped to stifle the American Projection Society. "Let the other fellow do it," has been the cry.

It is true that the Council has been a one-man organization, or, as Mr. Fuller expresses it, "never clear as to its . . . direction." Mr. P. A. McGuire is that one man; but who can say that he hasn't done admirable work under the circumstances? The Council can maintain no headquarters, can pay no salaries, can assume no large bills for stationery, printing and postage. But that isn't the fault of Mr. McGuire. Considering the tools with which he had to work, plus the discouragingly little cooperation he received, it is a matter for great wonder on the part of all Council officers how Mr. McGuire managed to do the vast amount of work that was done. One man indeed.

Indifferent Rank and File

Our experience with projectionist organizations has been that the more good work one does the more is expected from one by the rank and file. Until this condition changes greatly for the better we shall have to struggle along as best we can. Meanwhile, however, I see no reason why a paper which pretends to serve the projectionist should open its pages to one who has nothing but destructive criticism to offer. I should expect to find a projection paper right up in the front rank fighting away in the battles for projectionists and for projectionist organizations and resisting with all its might any attempt to minimize the efforts of either individuals or organizations.

As a projectionist, and particularly as President of the Projection Advisory Council, I am unwilling to let pass without condemnation such destructive tactics as are represented in this article by Mr. Fuller. Projectionists have a right to expect more considerate treatment within the pages of a projection paper.

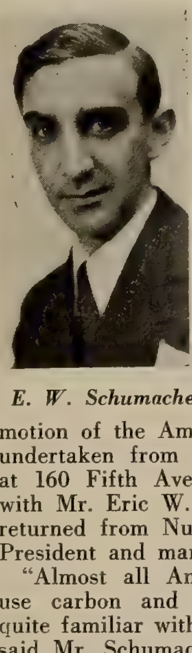
Incidentally, Mr. Fuller did not let slip by the opportunity to boost that publication in which his words were to appear. But Mr. Fuller is mistaken. *The American Projectionist* and not *Motion Picture Projectionist* was the first national projection paper. Just to keep the record straight. The phrase "consistently splendid work" as applied to a given publication is open to question, the answer depending on one's point of view. What may be one man's tonic may be another man's poison. The same statement applies to organizations, does it not, Mr. Fuller?

True to the "ideals" of the Council as a "publicity-seeking" organization, I shall close by saying that the Council is very much alive, is doing very good work, and invites the support of all I. A. projectionists.

Screen Data Omitted

THE second installment in the series of articles titled "Questions and Answers on Projection Screens", begun last month, is not included in this issue as promised, the reason for which omission being that differences of opinion as to the accuracy of certain data contained in this series make it desirable that all controversial points be carefully checked prior to publication. Several of the tests could not be concluded in time for this issue, hence the omission.—*Editor.*

NORIS CARBON CO. TO HANDLE CONRADTY CARBONS HERE



E. W. Schumacher

THE establishment of headquarters in New York City under the name of Noris Carbon Co., Inc., marks the first step in what is expected to be an intensive campaign to acquaint the American theatre and radio industries with the carbon products of C. Conradty, of Nuernberg, Germany, who have been active in the carbon field since 1855. Promotion of the American market will be undertaken from the New York offices at 160 Fifth Avenue, New York City, with Mr. Eric W. Schumacher, recently returned from Nuernberg, in charge as President and managing director.

"Almost all American concerns who use carbon and carbon products are quite familiar with the name Conradty," said Mr. Schumacher. "In America as in practically every country in the world, Conradty has been identified with high quality products. Projector carbons and carbon products for the radio industries have helped to maintain the Conradty reputation for quality throughout the world. Extensive preparations have been made for the sale of Conradty products in America, and no element which enters into the manufacture of a quality product has been overlooked. I feel confident that Conradty carbons will enjoy widespread acceptance in America and will make a host of new friends for the Conradty firm."

The Noris Carbon Co., Inc., is now ready to supply projector carbons, in all sizes, for every projection purpose. Dealer arrangements are progressing rapidly, and complete distribution of Conradty carbons is expected shortly.

THE WHAT, WHY AND HOW OF SOUND VACUUM TUBES

James J. Finn

II. Evaculating Process and Methods of Testing

THE degree of vacuum to which the bulb is exhausted may be considered second in importance only to the proper preparation of the filament, and is one of the decided points cf difference between a good and a poor one.

The evacuating process from which the rather vague appelation "vacuum tube" is derived, consists of the physical exclusion, by a complicated process, of almost all of the gases from the inside of the glass bulb. The ideal condition under which the elements comprising a thermionic vacuum tube should operate is in a complete vacuum. Now, *a total vacuum is practically unknown;* consequently, it is not to be expected in a commercial article. Nevertheless, the nearer the approach to it that can be obtained commercially, the better and more efficiently the vacuum tube will be likely to operate.

When gas molecules are present inside the glass bulb they interfere with the free passage of the electrons between the filament and the plate, and collision occurs. The free moving electrons move with great velocity, and when one of them strikes a gas atom with sufficient force, it may dislodge another electron from the atom. This electron follows the original electron stream to the plate, leaving behind a positive residue which, as in the case of the divided barium atom, form an *ion.* This ion, being positive, flies in the opposite direction to the electron stream towards the filament and does two things: (1) it bombards the filament violently, which tends to tear away its oxide coating, and (2) it acts as a positively-charged grid, thereby increasing the positive field and the current flow to the plate.

The electron stream to the plate being thus amplified, bombards the plate surface more and more violently until the plate itself becomes red hot and acts as a separate emitter of electrons. When this occurs, the tube breaks down and distortion sets in.

Extreme precautions are taken, therefore, to insure that as many of the gas particles as possible are withdrawn from the tube during evacuation. The process followed in this regard is termed "pumping."

Before the inside of the tube has been assembled in its glass encasement for pumping, all grease, oil, oxides and other impurities have been removed from the surface of the glass support and the nickel plate, grid, and wire supporting elements by suitable and careful treatment. All metal parts are pre-treated in high vacuum furnaces and in hydrogen furnaces to cleanse them "internally." This sounds like a strange process for solid parts, but the vacuum requirement specified for Western Electric tubes is so severe that not only does the space within the tube have to be free of gas, but the parts themselves must be free also, to be sure that no occluded gases will be freed during the operation of the tube.

Evacuating Process

The time interval between the furnace treatment and the pumping operation is kept as short as possible to avoid reabsorption of gases.

In preparing the tubes for the pumping operation, the tubulation from the glass bulb is first sealed onto a glass manifold which is capable of accommodating six tubes. These tubes and the manifold are encased in an oven which is electrically heated, and the filament, grid and plate connections are connected to suitable sources of voltage.

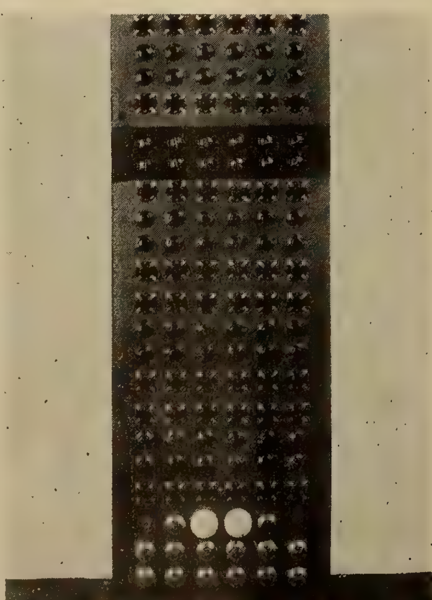


Fig. 3 Section of life testing rack for vacuum tubes

The pumping system for exhausting these tubes consists first of a two-stage, rotary oil beam capable of exhausting the tubes to a vacuum equivalent to a pressure of one-thousandth of a millimeter of mercury. Following the oil pump is a mercury diffusion pump capable of raising this vacuum to a pressure equivalent to one-millionth of a millimeter of mercury.

Interposed between the mercury diffusion pump and the manifold is a liquid air trap for condensing the murcury vapor. Mercury at room temperature, approximately 20° C., has a vapor pressure higher than that which can be obtained with the diffusion pump and much higher than can be permitted in the vacuum tube. By interposing this liquid air trap between the diffusion pump and the manifold, the mercury vapor pressure at the outlet of the manifold is reduced to that at liquid air temperatures, which is lower than the required pressure in vacuum tubes. Consequently, an extremely low pressure area is created at the outlet of the manifold, which gases from inside the tube attempt to raise by flowing out toward this low pressure area. These gas particles are carried along by the mercury vapor stream and are drawn out by the oil pump, leaving behind the condensed mercury vapor for further use.

After a good vacuum has been obtained by the pumping system alone, the temperature of the oven surrounding the tubes is increased as high as possible without causing a softening or collapse of the glass bulb, in order to expand and liberate as much of the occluded gases in the glass and metal parts of the tube as possible. After thoroughly baking the tubes for a while with the pumping system still in operation, the filaments are lighted and voltages are applied to the grid and the plate elements of such a value as to create an electron bombardment sufficient to heat the anodes to a temperature of from 800 to 1,000 degrees C.

As a final operation, a small amount of

an alkaline metal, known as a "getter," is vaporized within the tube to create a chemical reaction with any remaining oxygen or water vapor within the tube and bury other possible gases under the mirror-like coating which forms on the bulb.

The tube is then sealed off from the manifold and the pressure at that time in the tube is of the order of one-billionth of an atmosphere, or equal to the pressure of $\frac{1}{1{,}300{,}000}$ millimeter of mercury.

Measuring Degree of Vacuum

The importance of obtaining a high degree of vacuum has been described; how then is this degree of vacuum ascertained? By means of a rather simple affair, not unlike a vacuum tube, and called an ionization manometer, gas pressures may be measured to one-trillionth of an atmosphere. This manometer is sealed onto the pump station or to the tubes under test in the manner shown in Figure 5. (The manometer is the smaller of the two tubes.)

The essential parts of an ionization manometer are a thermionic filament or cathode, an anode for collecting electrons and a collector for the positive ions. The filament is heated to a temperature at which electrons are emitted, the electron anode is raised to a potential of 100 volts or more, positive to the filament, in order to attract these electrons, and the ion collector is maintained at a potential of from 6 to 9 volts negative to the filament. When gas is present in the system, collisions will occur between the emitted electrons and the gas particles, thus forming positive ions which will be drawn to the ion collector.

The positive ion current is indicated on an ion current meter and will be proportioned to the gas pressure in the tube. As the gas pressure becomes less, the meter reading becomes less. By knowing the characteristics of the manometer and the value of the electron current, a true measurement of the degree of vacuum reached may be obtained.

Fig. 4. Life test rack for testing ¼-ampere filament tubes

After an ageing process the tube is given a preliminary inspection to insure that it will meet all its requirements, then the base is put on and the tube is ready for its final test.

Testing Process

The tube is finally given a complete electrical and mechanical inspection. The filament resistance, the degree of vacuum, the impedance, the amplification factor and the amplification of the tube in a circuit—all are measured. The amplification in this circuit can be measured to within one-tenth of a decibel.

The maintenance of satisfactory characteristics over a long life is one of the principal requirements of Western Electric vacuum tubes. Life testing, therefore, is one of the important functions carried out, and special equipment and circuits have been devised for this purpose. Because of the extreme length of life of the tubes and the large number that have to be tested, new circuits have recently been developed which combine economy of space and maximum ease in making these tests. Twelve circuits, each arranged for testing six tubes, are mounted on a single bay of a relay rack. Additional bays are added when expansion of the testing facilities is required. (Figure 3.)

When making the life tests the applied plate voltage is the same for all tubes under test, but the grid potential is separately adjustable for each circuit, and the filament current is separately adjustable for each tube.

The cathode or filament temperature is the most important operating parameter of a tube, and in these tests it is controlled by regulating the filament current. Filament power is supplied by a small transformer in each circuit, which is fed from a 110-volt, 60-cycle source through a voltage regulator of the saturated iron type. The regulator is so designed that it supplies the transformer primary with a constant voltage regardless of load conditions or line voltage. Because of this constant voltage the filament current remains fixed at the correct value once the rheostat in the filament circuit has been adjusted.

The grid-biasing potential is obtained from a battery of dry cells which is provided with end cell taps. These are run to each of the twelve grid control switches on each bay. Since the plate voltage remains fixed, the plate current is controlled only by the grid potential.

Other features of the life-testing circuit are: protection against short circuits between the filament and grid, should the filament of one of the tubes burn out and fall against the grid; fusing of both plate and filament circuits, and total absence of test meters from the test racks. To add meters to the racks would greatly complicate the wiring and reduce the effective test positions as well as increase the cost of the test equipment. A special mobile test wagon was therefore designed which can be wheeled into position in front of the test racks. On this wagon are all necessary test instruments, which may be connected to the tube test positions by means of a plug. (See Figure 4.)

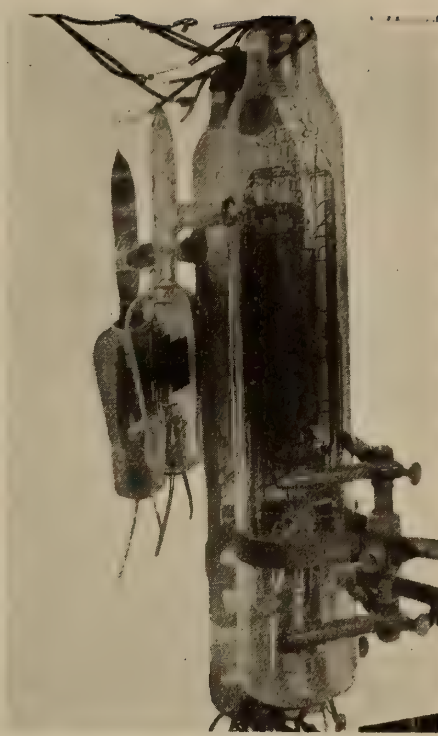


Fig. 5. New ionization manometer

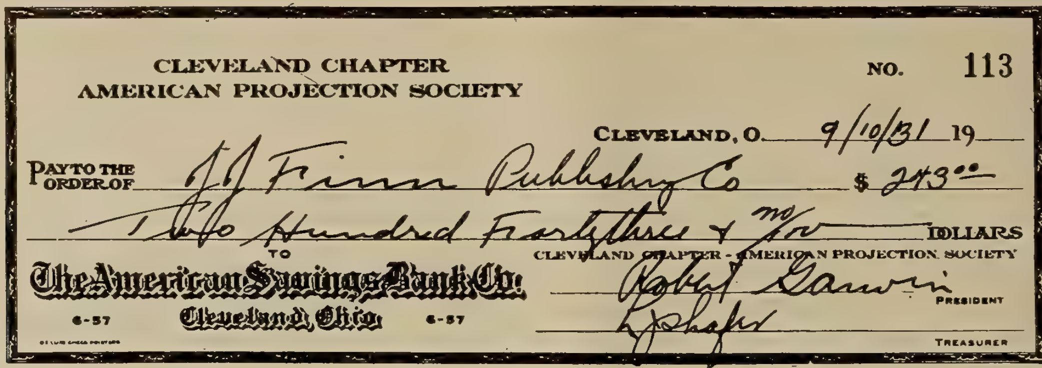
(To be Continued)

SONOLUX EXCITER LAMPS

Exciter lamps for all makes and types of sound picture reproducing systems are now being manufactured and distributed by the Sonolux Company, 3 Central Avenue, East Newark, New Jersey. Several of the larger theatre chains have standardized on Sonolux and many dealers throughout the country have ample stocks. Sonolux lamps are guaranteed by the makers to render perfect satisfaction over remarkably long periods of time, and because of their low cost to effect definite operating economies.

NEW WEBER DISTRIBUTOR

Motion Picture Sales & Service Co., with headquarters at 1501 Broadway, has been incorporated for exclusive distribution in the metropolitan New York area of products produced by the Weber Machine Corp. of Rochester, N. Y., manufacturers of Synchofilm sound equipment. Development of a new portable sound and visual 35 mm. sound-film projector complete with amplifier and speaker has also been announced by the Weber Machine Corp.



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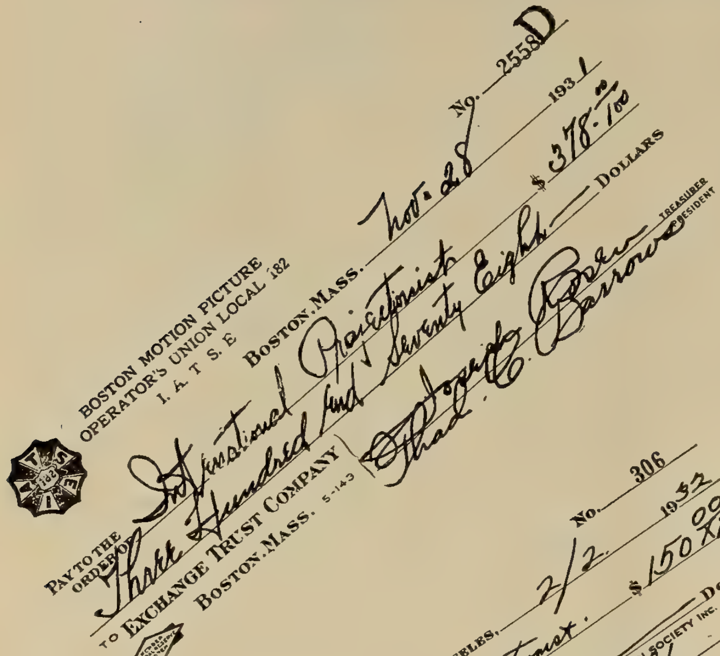

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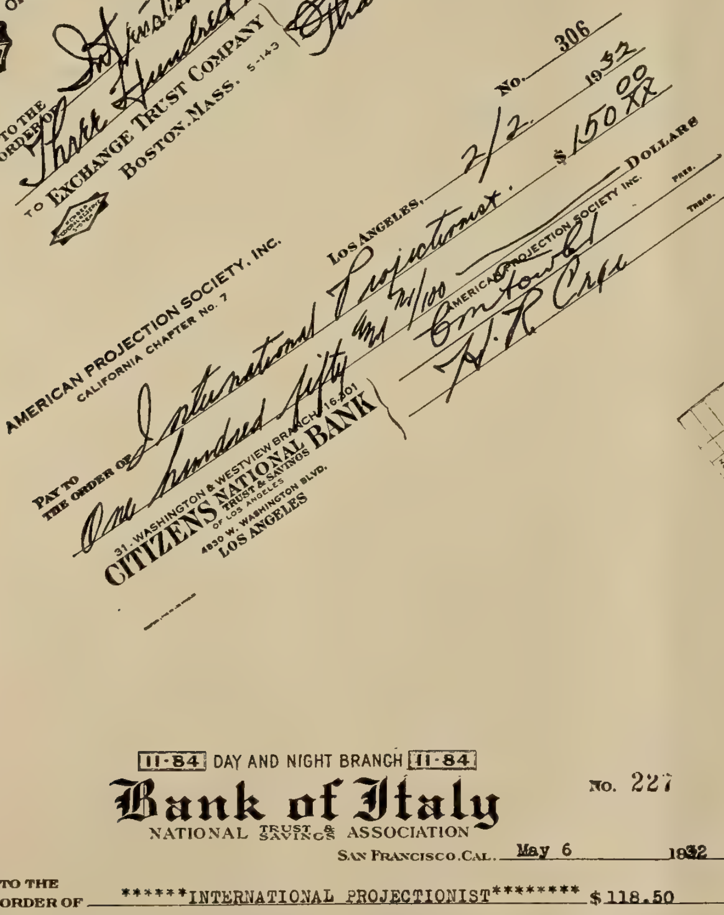

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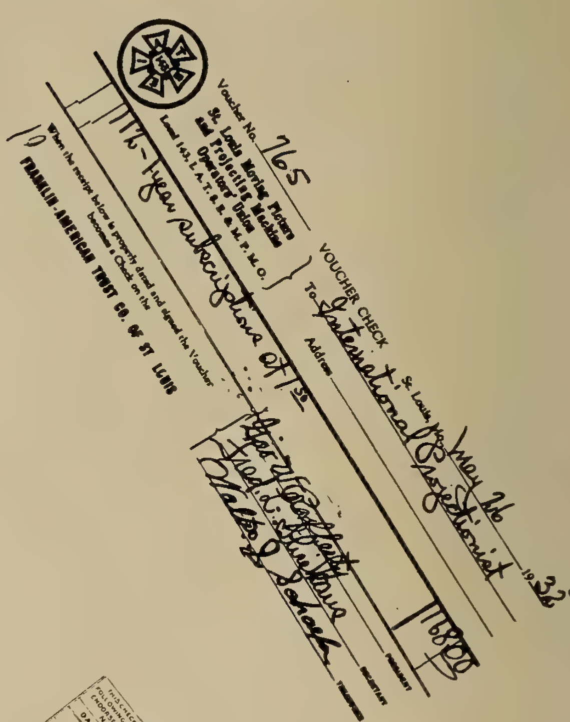

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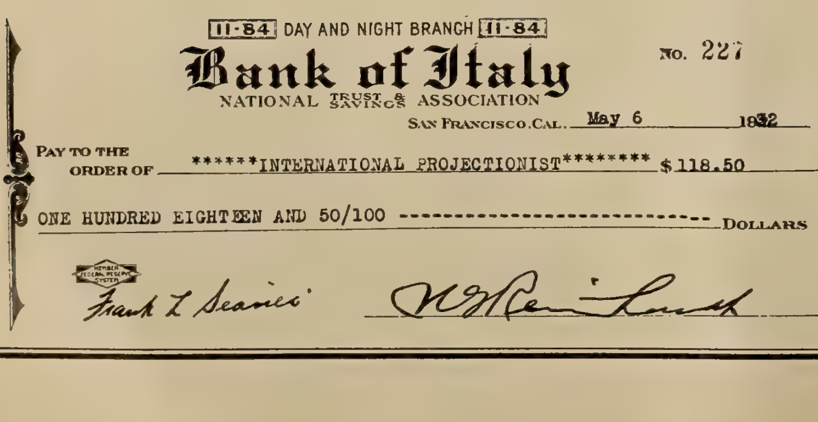

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Frank L. Seavies

EXTENDED FREQUENCY RANGE OF FILM (RCA System)

G. L. Dimmick and *H. Belar*

ENGINEERING DEPARTMENT, RCA-VICTOR CO., INC.

Here is presented the first comprehensive description of the recording process for extending the frequency range of film (RCA System, to be known as "High Fidelity"). The accompanying article was included in the paper's program of the Spring, 1932, *meeting of the S.M.P.E.*—Editor.

IMPROVEMENTS that have been made recently have materially extended the volume and frequency ranges of sound recorded on film and reproduced from film. The loud speaker has in the past been the principal factor in limiting the low-frequency response. One type of loud speaker, employing a dynamic cone and a directional baffle, and which responds well at frequencies from 60 to 10,000 cycles per second, has been designed (Fig. 1). This speaker is of the exponential type, is 10 feet long, and has a mouth 75 inches square. The driving unit consists of a cone 6 inches in diameter, with a voice-coil wound with aluminum wire.

The film presents no serious difficulties in recording low frequencies; however, it has been the principal cause of attenuating the high frequencies. For any given speed of film and width of recording light beam, a cut-off occures at a definite high frequency when the width of the recording beam is equal to one wavelength.

The limitations of the resolving power of the film usually cause considerable attenuation at a frequency much lower than that at which cut-off theoretically occurs. The resolving power of the film depends upon the emulsion; and for a given emulsion is a function of the manner in which the light beam enters the film, the stray light incident upon it, and the method of processing.

As the result of having made a careful study of each of these factors, it has been found possible to reduce considerably the attenuation of high frequencies. By using a galvanometer having a large reflecting mirror, the stray light ratio has been greatly reduced and the available light has been increased, thus making is possible to reduce the width of the recording slit and to increase the depth of focus of the objective lens in the optical system of the recorder. The residual loss due to the film is compensated for in the recording amplifier.

Figure 2 shows the construction of the new dry type of recording galvanometer. A silicon steel armature, *a*, is clamped between two laminated silicon steel pole pieces, *b*, being separated from the pole pieces by two nonmagnetic spacers, *e*. The free end of the armature is ground to form a knife edge, which fits into a groove in the semi-cylindrical mirror plate, *k*. A phosphor bronze ribbon is fastened to two prongs, *h*, and passes over the mirror plate. The two prongs press against the pole pieces and tend to spring apart, providing a small tension in the ribbon. The slight angle between the ribbon and the face of the pole piece results in a component of force tending to hold the mirror plate against the armature.

A plane silvered mirror, 0.125 inch long by 0.100 inch wide, is cemented to the mirror plate, the cement also preventing relative motion between the mirror plate and the ribbon. A force applied near the end of the armature deflects it in a manner similar to a cantilever beam. Since the phosphor bronze ribbon prevents lateral displacement of the mirror plate, the latter is free to vibrate only rotationally about a center through the ribbon. A major part of the controlling stiffness is due to the armature itself, the remainder being in the ribbon. A portion of the flux from the two cobalt steel magnets passes through the two air gaps, *g*.

Two coils, *c* and *d*, surround the armature, but are not in contact with it. Coil *c* carries the voice current from the recording amplifier while coil *d*, wound with many turns of fine wire, carries the biasing current required in eliminating ground noise. A rubber pad, *f*, provides the desired damping at resonance, which occurs at 9,000 cycles.

Figure 3 shows schematically the recording optical system of the recorder. Light from the recorder lamp, *a*, is collected by means of a condenser lens, *b*, and is brought to focus on the galvanometer mirror, *e*. A triangular aperture placed at *c* is focused by means of the correctedl lens, *d*, upon the mechanical slit, *g*. A condenser lens, *f*, concentrates the light passing through the slit, *g*, to form an image of the mirror, *e*, upon the back lens of the microscope objective. The objective lens, in turn, forms an image of the slit upon the film. The galvanometer mirror vibrates about an axis parallel to the slit.

New Sound Track

This new optical system for recorders produces a symmetrical double-edged variable width track, as shown in Figure 4. The cross-hatched portions of Figure 4 represent the beam of light reflected from the mirror of the recording galvanometer, and the narrow rectangles represent the recording slit. The arrows indicate the direction of vibration of the light beam.

Figure 4 (*A*) illustrates a normal vari-

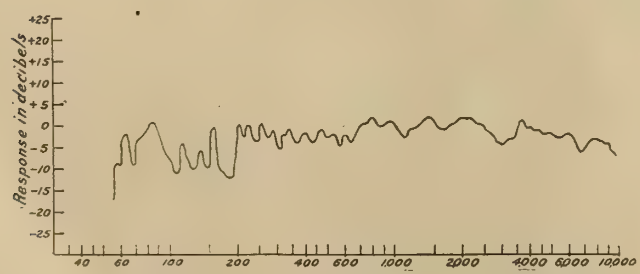

Fig. 1. Response-frequency characteristic of loud speaker

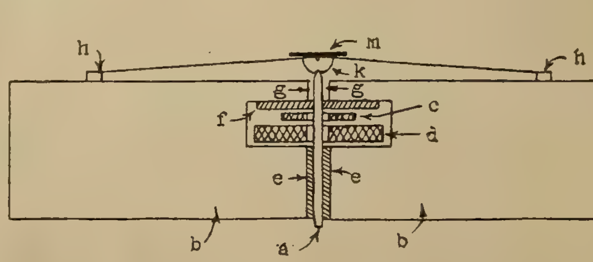

Fig. 2. The recording galvanometer

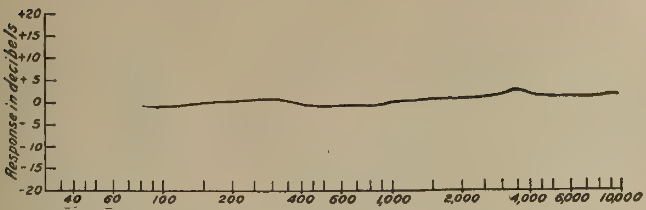

Fig. 5. Response-frequency characteristic of ribbon microphone

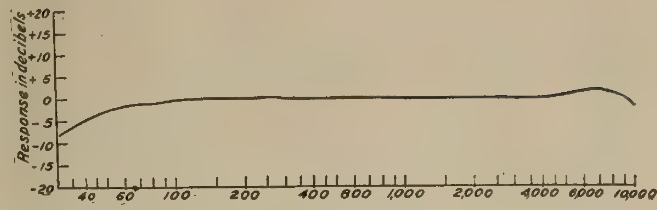

Fig. 6. Response-frequency characteristic of reproducing amplifier

able width track. The average transmission of such a track is 50 per cent, regardless of the amplitude of the recorded wave. Figure 4 (*B*) illustrates the kind of variable width track now being used, which utilizes a separator shutter for blocking a portion of the light beam when the recording level is low. The black rectangle in this figure represents the shutter vane. The current that actuates this vane is obtained by rectifying and filtering a portion of the signal.

Figure 4 (*C*) shows how the double-edged symmetrical track is made. The triangular beam of light moves at right angles to the axis of the slit, so that as it vibrates, the length of the illuminated portion of the slit varies. As in Figure 4 (*A*), the average transmission of this track is 50 per cent. Figure 4 (*D*) illustrates a sound track made by this method, utilizing the biasing system of eliminating ground noise. The mean position of the triangle depends upon the current that is supplied to coil *d* (Figure 2) by the biasing amplifier, which is controlled by the incoming signal. When there is no signal the triangular beam of light is biased to the position shown in Figure 4 (*D*), producing a very narrow transparent line down the center of the track. When a signal is impressed upon the system, the biasing current is reduced, and the triangular beam of light is raised until the track is sufficiently wide to accommodate the signal.

The symmetrical track may be reproduced by standard theatrical equipment without change.

Film Speed Vital Factor

The extension of the frequency range has made more urgent the necessity of maintaining accurate constancy of film speed in both recording and reproducing machines. Variations of the speed of either the recorder or the reproducer produce the so-called "wows." When the variation of speed occurs at a high frequency, due, perhaps, to gears or sprocket teeth, a more harmful kind of distortion is introduced. Due to speed modulation the high frequencies are distributed into several side-bands, and the reproduced notes sound rough or "wheezy." Variations of speed have been reduced to a minimum in the new recorder and in the reproducer.

Another important improvement made in the system lies in using a microphone of the ribbon type, which furnishes uniform response at frequencies ranging from 40 to 10,000 cycles per second. The directional characteristics of this microphone are independent of frequency.

The new high-quality recording and reproducing equipment was demonstrated at the Spring, 1932, meeting of the S. M. P. E. Two loud speaker units similar to the one described were employed, being placed behind a perforated screen. The reproducing amplifier had an undistorted power output of 40 watts. It was operated completely by alternating current, and was assembled on a single rack that contained all the necessary electrical equipment. Figure 6 is the frequency-response curve of this amplifier. The demonstration records were reproduced on a film phonograph that employed a magnetic drive similar in principle to the one previously described by E. W. Kellogg.[1]

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[1] KELLOGG, E. W.: "A New Recorder for Variable Area Recording," *J. Soc. Mot. Pict. Eng.* 15 (Nov., 1930), No. 5, p. 653.

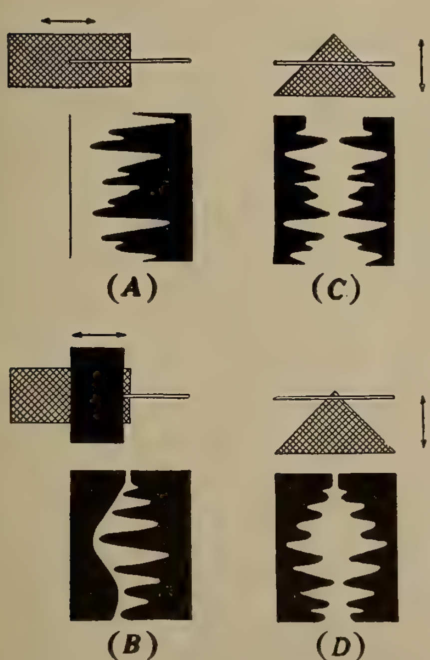

Fig. 4. Four types of variable amplitude sound-on film track

RANDOM NOTES ON EXTENDED FREQUENCY SYSTEMS

James J. Finn

ANOTHER milestone in the progress of the sound picture art has been passed with the introduction of recording and reproducing apparatus which extends materially the frequency range. Epoch-making is the term which correctly describes this new development, but it is to be feared that the general moviegoing public will not appreciate its significance in the same measure as do the technical workers in this field. High-quality sound reproduction, in which marvelous tonal quality plays so important a part, undoubtedly will "sound good" to Mr. Average Man, and with this measure of praise will the hard-working technicians have to be content. But here we are talking about public quality-consciousness instead of technique and equipments.

This writer has heard extended frequency range systems developed by both major sound companies in this field: the High Fidelity system (to give it its formal title), of the Photophone Division of RCA-Victor Co., Inc., and the Wide Range system of Electrical Research Products, subsidiary of Western Electric. Both systems evidence a difficult problem intelligently approached and smartly executed and both represent a job so well done as to offer little, if any, basis for direct comparison. Magnificent sound, comparatively speaking, is the net result in both cases. One who knows even the least bit about the art cannot help but be tremendously impressed by the full rich tone, the marvelous sweep and surge and the unerring control demonstrated by these new sound systems.

In the last analysis, reproduction will prove the merit of both these systems. In this connection a word of warning might be sounded. No sound company, as such; no engineer, no commercial

New RCA 'High Fidelity' Double-Edged Sound-on-Film Track

A

A—In the earlier type of variable area sound track, the single-edged black silhouette of the sound wave was employed to vary the width of the light beam which was directed upon the light-sensitive cell. The entire remaining portion of the sound track not occupied by this black silhouette permitted light to pass. However, the natural grain of the film, plus small dirt particles which adhered to its surface, served to cause a host of infinitesimal shadows in this light beam, which resulted in a rushing and crackling sound called "ground noise". In this case where the black silhouette was the smallest in area, the sound volume was lowest, and the "ground noise" produced by the relatively large clear area was then at its greatest volume—and, of course, more noticeable to the listener.

B—In the modern "High Fidelity" sound track, a symmetrical or double-edged image of the sound wave is employed—and it is reversed, clear for black, compared with the earlier type of sound track shown at "A". The entire background of the sound track not actually occupied by the clear image of the sound wave is now black. Therefore, when the sound is at minimum volume, the clear portion of the track is narrowest, and the black background which occupies the entire remainder of the sound track completely shuts off the remainder of the light beam. Thus, the film grain and even the dust particles in this black area have no effect whatever upon the resultant reproduction, and the so-called "grounl noise" is now absent in "High Fidelity" system. s stem.

B

man should further the idea that extended frequency range is something to be played around with, something to be regarded as a mere attachment to or improvement upon existing reproducing apparatus.

Extended frequency range recording seems to this writer to require ideal reproducing conditions if its full value is to be realized. Every element in the system must be right. There must be no halfway measures about it. Fitting extended frequency range to existing apparatus is all very well as a catchline, but that it will work out well in practice is seriously to be doubted. Diamonds are not set in lead settings; extended range recordings should not be reproduced by means of *limited range* equipment. Strict honesty and absolutely on-the-level dealing should characterize the promotion of this equipment.

The High Fidelity system of RCA Photophone is credited with the ability to encompass the full range of from 40 to 10,000 cycles. Differently expressed, this range is so close to that which is considered to include "everything" as to render silly any hair-splitting discussion of lower or higher levels. It is generally agreed that a majority of existing reproducing equipments cut-off sharply at 4,000 cycles—although it seems to this writer that many equipments cut-off noticeably this side of that figure. The question naturally arises: "What will happen when a recording closely approaching 10,000 cycles is run through a majority of reproducing equipments now used in theatres?" The answer is: "Nothing".

An amplifier that cuts-off sharply in the neighborhood of 4,000 cycles will cut-off an extended frequency range recording precisely at that point. The only advantage of 10,000-cycle recording in this instance would be a further reduction in ground noise. Changes in existing reproducers are necessary, positively so, otherwise we shall have no material benefits from this new development.

RCA Photophone asserts that any of its equipments dating not farther back than two years will reproduce satisfactorily up to 8,000 cycles. Those equipments antedating that period will have to be altered. In all cases, installations of RCA's High Fidelity system will require a new sound sprocket and a different baffle for the speaker. Inclusion of the very high frequencies means that sprocket wear to even a slight degree can no longer be tolerated, as the slightest wear will manifest itself in a pronounced flutter in the reproduction.

As with every refinement of the art, extended frequency range systems require additional watchfulness and care by the projectionist. An explanatory note on the new RCA sound track is appended hereto, together with drawings of both new and old tracks.

Erpi's Wide Range System

Wide Range, the ERPI extended frequency range development, possesses the same general advantages previously cited herein. This writer was privileged to hear this new ERPI development at a private demonstration at which a clever method of changeover from old to new reproduction enabled the hearer to make an accurate comparison of relative merits. Needless to state, the new Wide Range so far outstripped the old method as to occasion wonderment that the latter ever was tolerated. It's a beautiful piece of work in every respect, and a first hearing of a special organ recording by Wide Range is as thrilling an experience as one could desire.

Specific details as to requisite changes in existing ERPI equipments in order to fit them for faithful reproduction of Wide Range recordings are not available at this writing. The writer is aware that the new ERPI systems employs a filter system which splits the frequency range into "highs" and "lows", 3,000 cycles being the dividing point, with the outputs being fed into a combination of two horn units.

Whether the general public will be properly appreciative of this new development is not the concern of this article. Radio manufacturers, prodded to improve the frequency response characteristics of their sets, replied with smug assurance that the public was so educated to poor sound reproduction that it not only would not appreciate high quality reproduction but actually would resist it. Maybe this represents an accurate reflection of public taste (which I doubt); but if it should be so, then all efforts to improve the sound reproduction art should cease at once. On this theory, the motion picture business and all other businesses might just as well call it a day insofar as refinement and progress are concerned.

This new extended frequency range recording and reproduction is great stuff. It's grand. It's magnificent.

NEW SIMPSON CO. TO HANDLE BRINNER LENS BUSINESS

THE Simpson Instrument & Lens Corporation, 1737 North Campbell Avenue, Chicago—a newly formed corporation of which Ray Simpson is president—has purchased the lens business of the Brinner Optical Manufacturing Company. The new company will specialize in the manufacture of scientific lenses, as well as special lens development work for manufacturers and lens repair service. Mr. Simpson was formerly president of the Jewell Electrical Instrument Company.

PRE-RELEASE TREATMENT FOR ALL NEW PRINTS

Trevor Faulkner

EXCHANGE DEPT., PARAMOUNT-PUBLIX CORP.

Projectionists will recall the article "Lubrication of Motion Picture Film," by Messrs. Crabtree and Ives, which appeared in this publication for July, 1932 (Vol. 3, No. 1, p. 7). Bearing directly on certain salient features of this article is the accompanying contribution of Mr. Faulkner to the symposium on Theatre Problems of the Release Print which was a feature of the Spring, 1932, meeting of the S. M. P. E. Mr. Faulkner, attributing to projectionists their rightful share of responsibility for film mutilation, at the same time defends them against the charge, made many times, that they are responsible for a major portion of film damage. His article goes further and helps to dispel the illusions heretofore existent about many other phases of film handling.—Editor.

THE problem of treating motion picture film prior to releasing it for projection is a very important one for both distributors and theatres, referring particularly to the treatment of the film immediately after printing, developing and drying. This paper is constructed upon observations made of the work of the department of a major distributor responsible for the maintenance of film in thirty-nine branch exchanges scattered throughout the United States.

This department had been successful with its film maintenance problems to the point where the only serious difficulty that remained was the susceptibility of freshly developed film to become damaged prior to its having become seasoned by undergoing a sufficient number of screenings.

About 90 per cent of the damage sustained by new film occurs in the projection room. But although some projection rooms may be poorly equipped and operated by negligent or uninformed projectionists, I would state here emphatically that by far most projection rooms in which new film is used are well equipped and have competent men in charge of them. The damage, then, in some instances, is beyond the control of the projectionist in whose room it occurs and cannot be prevented by him.

New film may be damaged in three ways: (1) by straining or tearing the perforations; (2) by scratching the emulsion, and (3) by the film's becoming buckled or warped, due to the shrinking or swelling of the gelatin when exposed to the heat of the projection lamp.

The straining or tearing of perforations is, in most cases, due to the condition of the film itself, and cannot always be averted by competent projectionists even when the projectors are in good operating condition. This damage usually occurs during the first four or five passages of the film through the projector, and results from the depositing of emulsion on the shoes of the aperture plate. These deposits rarely accumulate to such an extent that the pressure between the aperture plate and the tension on the opposite side of the film is increased sufficiently to cause the teeth of the intermittent sprocket to tear the perforations by forcing the film down in front of the aperture; but the smallest deposit of emulsion on either of these shoes may, by baking, become so hard that its action on the emulsion of the film when passing over it is similar to that of passing a diamond over a pane of glass.

When the diamond does not scratch the surface of the glass, it drags very little; but once it "bites" into the glass, the drag or traction may become consid-

erable. This kind of effect occurs with film. Before the deposit of emulsion has acquired a "cutting edge," the film is permitted to slide over the deposit rather easily, and there is little probability of damaging the film. But once this smooth surface is changed, by further accretion of emulsion, into a cutting edge, it begins to cut into the emulsion, creating a resistance to the free passage of the film so that the teeth of the intermittent sprocket may tear the perforations in forcing the image past the aperture.

When such deposits of emulsion accumulate and interfere with the free passage of the film over the aperture plate, the projectionist is warned of the situation by the excessive noise made by the intermittent movement in protest against its overload. The projectionist can do only one of two things: either place a lubricant of some kind on the film before it arrives at the aperture plate, or stop the projector and remove the deposit that is causing the trouble. Neither of these procedures is followed by the average projectionist except in emergencies.

Scratches in the emulsion, in the picture area of the film, are nearly always caused by carelessness in handling the film, either in the projection room or in the exchange inspection room, or by improperly adjusting projectors or allowing dirt to accumulate in them. Long runs of film, made under the best conditions of operation, have indicated that damage due to these causes can be reduced very considerably; but a visit to almost any theatre in which is being projected film that has been booked once or twice before and which has not been properly treated prior to its initial run, will disclose a screened picture marred by many scratches.

The buckling or warping of film is no inconsiderable item of film damage. The buckling or warping is either so bad that the picture cannot be kept focused on the screen, or is insufficient to cause any trouble at all. This kind of difficulty is likely to occur only with new film, unless the new film has been properly treated to obviate it, prior to its first screening; for it is due to the sudden withdrawal of moisture from the gelatin, or the swelling of the gelatin from being heated by the

RCA GOVERNMENT ORDER

With upward of 300 battleships, destroyers, cruisers and shore stations equipped with Photophone sound reproducing apparatus, the Navy Department has awarded a contract to RCA-Victor Company for the installation of similar apparatus aboard the U. S. S. Farragut, Dewey, McDonough, Hull, Minneapolis, Tuscaloosa, San Francisco and Worden. The U. S. Army, with 75 Photophone reproducing equipments in army posts throughout the world, also has placed additional orders.

projection lamp and is not likely to occur with film that has been properly seasoned.

It is evident that the efforts, artistic and technological, that have been made in producing a picture, will all go for naught if the effects produced are marred by physical defects of the film that present a satisfactory screening, but which could be prevented by proper treatment. Nearly all the difficulties described here are in connection with improperly treated, or untreated film and such defects do not occur in film the gelatin of which has been chemically seasoned prior to its initial screening.

Projectionist Not at Fault

When film is sent to a theatre in which it will be passed through a projector for the first time, that theatre is certainly entitled to receive film that has been thoroughly prepared for screening; and it should not be necessary for the projectionist to wax, oil, or otherwise treat the film so as to assure himself of an uninterrupted screening. Nor should the projectionist be held responsible for the oil that he must necessarily apply to film that is improperly prepared for screening when the accretion of emulsion causes the projector to protest loudly against overloading when pulling the film past the aperture.

Some of the largest producers and distributors have found a relief from these conditions by chemically treating the film at their laboratories; and it seems safe to say that it would be the wish of every projectionist in the country that all new film be given a treatment that would produce as good results for them as are enjoyed by these companies, so that they could feel reasonably sure that no film would be damaged while in their charge.

The distributor's interest in properly preparing prints for screening is restricted chiefly to that of assuring the satisfaction of the theatres; but the decrease in the amount of film that is damaged is incident to a like decrease in the number of controversies over the account, in the cost, and in the annoyance of making replacements; and the lengthening of the lives of the prints offers assurance that the final booking will be a satisfactory one because of the good condition of the print. All these factors figure in making the treatment worth while; but most important of all is the need of avoiding, so far as is possible, the loss of time on the booking records of prints that are withdrawn from service and are awaiting the replacement of damaged parts.

Large Revenue Loss

The revenue sacrificed by the distributor because of his inability to furnish prints of subjects that have been booked, or the expense and trouble involved in obtaining replacement prints either from the laboratory or some other exchange, assumes a huge amount, nationally, and is far in excess of the cost of treating film at the laboratory before shipping it to the exchanges. Such treatment not only assures the distributor of a positive saving, but also furnishes assurance that the theatre will be supplied with film that can be screened as satisfactorily on the first booking as on the last. It avoids what is today the greatest cause of controversy between the distributor and the exhibitor; namely, the loss or change of bookings, due to the distributor's inability to furnish a satisfactory print when the print that has been booked has been damaged and no other print is available.

Pre-Shipping Care

Before shipping film to the exchange, the laboratory should prepare it so that the booking department of the exchange could feel reasonably sure that the schedule of booking arranged for the film would not be upset by the condition of any of the prints, especially during the "circuit" or "peak" period. As for the satisfaction derived from the film, whether on the first booking or on the last, the small exhibitors who pay minimum rentals are as much entitled to satisfactory prints as the larger accounts, for the amount that the smaller accounts pay represents as great a percentage of their income as does that paid by the larger account; and their customers are certainly as entitled to the best film obtainable.

The average motion picture patron is not aware of the causes of the "rain," or scratches that appear on the screen, or of the in- and out-of-focus effect; but he does, perhaps unknowingly, appreciate the better quality of the picture when it is free from such defects.

Suggested Treatment

It is highly desirable that film be treated by the laboratories in such a manner that the following objectives may be achieved:

(1) The film should be able to make its first passage through the projector with the facility and ease of a seasoned film, thereby eliminating the

DEBRIE SERVICE STATION BUSY

A NUMBER of special cameras made by Andre Debrie for the U. S. Government and to be used by naval aviators, have been sent to the Debrie service station in New York for their first examination. These cameras include the famous Ultra Speed "GV's" which have been in use by the Government for a period of years.

danger of pulling or tearing the perforations.

(2) The gelatin should be chemically cured, so as to be protected against the scratching of the surface that occurs with practically all film during its first few screenings, unless so treated.

(3) The buckling, warping, or curling of the film incident to its being heated by the projection lamp should be reduced to a minimum.

(4) The pliability of the gelatin and its binder should be as permanent as possible, thus assuring a longer and hardier life of the film.

Any treatment of film that is not satisfactory in these respects is inadequate and of little importance in its application to film. Any process of treatment for new film, other than that of aging during the use of the film in projection, must be either a surfacing or an impregnating process. Surfacing processes consist in altering the existing surface, as by buffing, or in applying a new surface, as by coating. Coatings that are not made a permanent part of the film itself, and, as a result, may be left in the projector in the form of deposits, are, according to the size of the deposits, menaces to the correct reproduction of sound.

Buffing will help new film to pass through a projector freely, but it cannot offer definite assurance that the picture image or sound track will not be affected by alterations in the buffing surface, caused by the attachment of gelatin to it. Measurements made in ground noise tests readily prove this. Impregnation processes must refrain from using agencies that shorten the life of either the gelatin or the base, and must not alter the pliability of either of these.

Those who have been engaged in the endeavor to maintain prints in a satisfactory condition up to the time of the final booking date realize that it is now possible to achieve such a result, and that some of the major distributors are now preparing and maintaining their product so as to take advantage of this situation.

Technical Note

A mouse (not Mickey) got into the sound amplifier of the Grand Theatre, Latrobe, Pa., and gave ERPI's service engineers another chance to demonstrate their efficiency. The service engineer who reached the scene found that the rodent had penetrated the low levels of the 49 amplifier but had found the 46 amplifier too much for him.

[*Editor's Note:* As who hasn't?]

DEVELOPMENT AND USE OF THE SOUND PICTURE

(*Continued from page* 10)

the film laboratories was not particularly close.

Cameramen are artists who are painting a picture on a photographic film and each one has his own theories in regard to lighting, picture density and contrasts. It was necessary to evolve printing and developing formulæ which would satisfy the photographic requirements, leaving a large degree of license to the camerman, and at the same time produce a satisfactory sound negative and print. In addition, close technical control of the developing and printing processes in the film laboratories had to be established.

At first there was considerable conflict and compromises were necessary, but the early concessions have now been largely eliminated leaving the cameraman practically as much latitude as he previously had but with the added assurance of more reliable and uniform results in the better operation in the film laboratories.

Acoustic Problems

The experience in acoustics relating to the pickup of sound gained in phonograph recording and in broadcasting studios was applied to the motion picture stage, but it was soon found that where sight is combined with sound many of the old theories of voice input were not directly applicable. It was necessary to conduct an empirical study of the factors of seeing and hearing which coördinate to produce the illusion of naturalness and of perspective, and the

FREE TRADE IN IDEAS

OFFICES have now been opened in New York by Amerika-Interessen, Inc., organized as the American unit of A. G. Fuer Amerika-Interessen, operating also in Berlin, Paris and London. How the work of this corporation helps manufacturers in this country to surmount the tariff barriers which gridiron the world is explained in the following statement by Botho Lilienthal, president of the Corp.:

"Our method of operation is to make available to the manufacturers of one country, devices, processes and patents that have been proved successful in other countries. For manufacturers who wish to augment their incomes by obtaining business abroad, but cannot do so by exports, we negotiate agreements covering production and marketing rights. This is done by issuing licenses on a royalty basis or by the outright sale of the manufacturing and marketing rights for the country involved. In other words, we are endeavoring to replace the export of manufactured goods to some extent by bringing the inventive achievements, the engineering skill and manufacturing experience from one nation to the other. And, fortunately, there are no tariff barriers against such import and export of ideas."

knowledge thus obtained in the making of sound pictures has been applied beneficially to radio broadcasting studios and other enclosures in which correct acoustics are important.

Early experience with sound picture theatres proved that the acoustic problems were not limited to the studio. The theatre forms an essential element in the reproducing system, linking the loud speaker to the auditor. In the design of the silent motion picture theatre no thought had been given to acoustics, and seldom were satisfactory conditions unwittingly obtained. Studies of theatre conditions indicated that both qualitative and quantitative acoustic measurements were necessary if remedies were to be prescribed with any degree of certainty that an improvement would be obtained.

Two Outstanding Developments

This led to the development of the frequency analyzer, the level analyzer, the reverberation meter and the noise meter, all of which have been successfully used not only in the analysis of acoustic conditions in theatres, but in other fields as well, such as the New York subway, the study of railway structures, the silencing of noisy machines and the correction of auditorium acoustices. The success of the recent piano recital by Pederewski before an audience of 16,000 in Madison Square Garden without the use of any sound amplifying device evidences what can be done by proper acoustic treatment.

Two of the most outstanding improvements which have been effected in the past five years are the obtaining of sound perspective and the elimination of extraneous noise, which on disc records is termed *needle scratch*, and on film records, *ground noise.*

This so-called ground noise is caused mainly by irregularities in the sound track and would be practically eliminated if the sound track were black during silent periods, thereby cutting off all light from the photoelectric cell. This is effected by making the negative sound track substantially clear during silence through the closing of the light valve slit from a normal opening of one one thousandth of an inch to three ten thousandths of an inch through the medium of a unidirectional biasing current superimposed upon the fluctuating sound current. As the sound currents build up the effect of the biasing current is proportionately neutralized and the light valve operates so that full modulation is obtained without clashing of the light valve ribbons.

This, briefly, is the story of the talking motion picture to date. Now what of the future? What implication does this medium hold for the field of education and other forms of social endeavor? Is it capable of presenting material which cannot be presented equally as well by any other medium? Can certain matters be presented more economically by this method than by any other? Are impressions gained from the talking picture more vivid, more concrete, more lasting than from other media?

A Peek Into the Future

For a little more than two years we have been experimenting in cooperation with numerous educators and educational agencies with the use of the sound pic-

ture in the educational field. In this connection we have made a number of pictures and conducted a number of rather elaborately controlled field experiments. It has been pretty well determined that the talking picture furnishes a means for the elaboration of the student's environment better than any other medium yet used; it is a powerful stimulant to the imagination and in the presentation of certain general topics it effects a considerable economy of time.

For example in a test conducted recently at Teachers' College, Columbia University, certain highly technical aspects of teacher training were presented by a twenty-minute talking motion picture to one group of students, while another group were permitted to study the monograph from which the picture was made for half a day, but were not shown the picture. The former group made considerably higher scores than the latter on the subsequent test. Last, but not least, the talking picture can democratize education in much the same way that it has democratized the dramatic stage and the great teacher can be taken to students in the most remote district and material presented which heretofore has been reserved for the chosen few.

We feel that the case of the talking picture as an effective instrument in education has been proved, but the solution of the problems which it presents and its fullest development can come only through the wholehearted cooperation of educators and educational institutions who alone can furnish the insight necessary to complete realization of its potentialities.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of

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STATE OF NEW YORK } ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared James J. Finn, who, having been duly sworn according to law, deposes and says that he is the Editor of INTERNATIONAL PROJECTIONIST and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, James J. Finn Publishing Corp., 1 West 47th St., New York, N. Y.; Editor, James J. Finn, 1 West 47th St., New York, N. Y.; Managing Editor, none; Business Manager, Ruth Entracht, 1 West 47th St., New York, N. Y.

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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

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5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is . . . (This information is required from daily publications only.)

JAMES J. FINN, Editor.

Sworn to and subscribed before me this 5th day of October, 1932,

MAX KAHN.
Notary Public.
N. Y. County Clerk's No. 8.
Reg. No. 4K391.

[Seal] (My commission expires March 30, 1934.)

International PROJECTIONIST

Edited by James J. Finn

Vol. 4, No. 2
December 1932

A magazine devoted to better visual and sound reproduction

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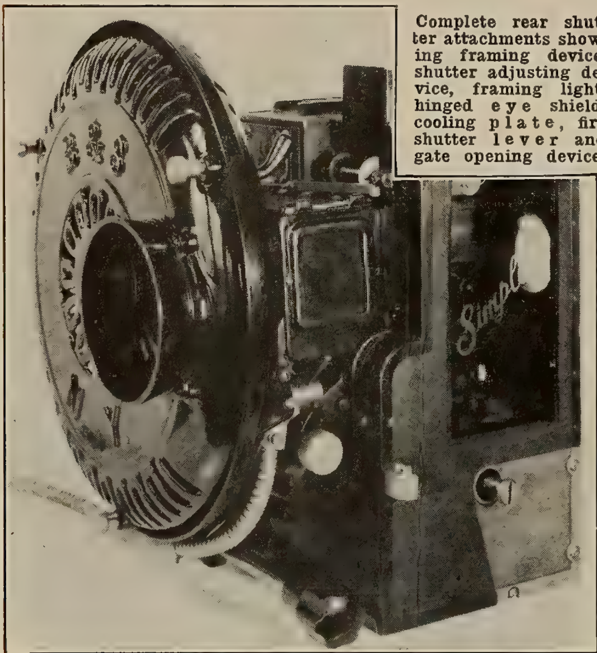

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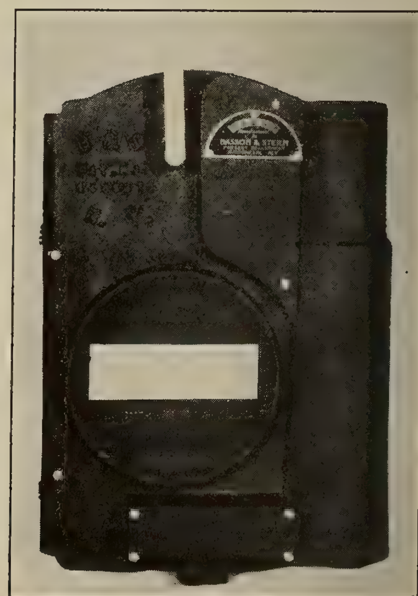

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International PROJECTIONIST

Edited by James J. Finn

Volume 4 DECEMBER 1932 **Number 2**

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MONTHLY CHAT

SO many requests for copies of the Report of the Health & Safety Committee of the Projection Advisory Council, published in these pages last month, have come in that the directors of the Council requested announcement of a plan whereby each Local Union would subscribe for a minimum of three copies at 25c each (a total of 75c), the proceeds of which sale would just about cover the cost of reprinting the report in pamphlet form. This report should make a valuable addition to the files of every projectionist union. Subscriptions should be sent to the Council at P.O. Box 98, General Post Office, New York.

WIDE film long ago was consigned to the scrap heap in the minds of projectionists. But work on at least one process continues right along. We have seen several recent demonstrations of this particular process, and we are able to report a 100 per cent improvement in quality over those pictures which were exhibited in 1929. Incidentally, this latest process strikes a happy medium with respect to size—about 45 mm., we should say. Remember that we told you.

PROJECTIONIST of our acquaintance finally wearied of a three-months' attempt to have his projector heads overhauled. So he sat himself down (not an unusual projection room practice, we hear), and dashed off the following note to the manager: "Dear Mr. ———: Your failure to act on repeated requests for overhauling of our projector heads forces me to inform you that from now on the projection staff will not be responsible for screen quality or for any accidents which may occur in the projection room. *A copy of this note is being filed today at our Union headquarters.*"

Result: within a few hours after the above note was delivered, two replacement heads arrived in the projection room.

OUR early summer prediction anent the imminence of the adoption of double reels as a standard is proven correct by current activity on the part of the Academy to effect joint action by all branches of the industry in support of such a standard. Many projectionists are inclined to favor double reels (the proposed new standard is 1,700 feet of film), but there is a sizeable group which will fight to the last ditch any deviation from the 1,000-foot film length. We should like to publish a few hundred opinions on this matter; but if we know our clientele, we shall expect only a few. Think it over—from all angles.

It seems inprobable that the Academy will proceed to adopt this standard without soliciting the opinions of representative projectionists. We wonder.

The IP EDITORIAL PAGE

Vol. 4, No. 2 DECEMBER 1932

The I.A. and the New York Situation

Current happenings in New York City in connection with the situation precipitated by the action of the General Executive Board of the Alliance in removing Sam Kaplan and twenty associate officers of Local 306, transcend in importance to every Alliance member any topic—or, conceivably, any group of topics—that might be discussed herein. It reflects no flight of the imagination to state that the outcome of the fight now being waged in New York City is of vital importance to the future of the Alliance as a potent labor organization. In the forefront of that group arrayed against the Alliance, sad to relate, are not its natural enemies but its erstwhile "friends", in the persons of Sam Kaplan and associates.

Examination of the record of the hearings in the Kaplan case indicates that there never was an International that had as much right on its side in any case as did the I.A.T.S.E. in its action against the Kaplan crowd. The details of the charges against the Kaplan crew—charges, incidentally, upon which they were given every opportunity to be heard—are too well known to readers of this page to require recounting. Suffice it to say that if even one of the many charges against these men be true, then they fully deserve that punishment (and rather mild punishment it is, too), meted out to them.

High praise is due President Elliott and other members of the General Executive Board for the courage displayed in acting against the Kaplan crowd. That the job was no sinecure is attested to by the fact that today, five weeks after Kaplan's removal, there still is enough "heat" in the situation to promise months of trouble and uncertainty. Every effort being made by the Alliance to rehabilitate Local 306 and to get a square deal for its members is being fought by a combination of forces which includes racketeers, politicians, "money men", "syndicate" directors, and "influential citizens" who "fix" things.

Three phases of the New York situation are all-important (1) the action of Kaplan in fighting the Alliance in the courts (2) the removal of the Alliance control over Local 306 through appointment of receivers, and (3) the grave danger inherent in a situation which permits of more than 1,300 men being tossed from pillar to post in what may be described as a lawyer's holiday.

Sam Kaplan's going to court is the one humorous aspect of the case, sticking out from under the seriousness of it all. Picture that "greatest labor leader in America," so-called by his fawning hangers-on, who, the moment he was removed from office (not expelled, suspended or fined, mind you), yelled "cop" and rushed off to court in tearful mood, much after the fashion of those members who during the years he controlled Local 306 evoked the wrath of "God" for doing the same thing. If Kaplan's memory be long, he probably recalls the penalty meted out to these members. Kaplan's latest manifestation of regard for that organization which literally "made" him is his approval of a receivership for Local 306.

This receivership business is really very serious. President Green of the A. F. of L., in a wire to President Elliott, stated that the laws of an International should not be disregarded or set aside even by a court—a statement which drew the critical fire of New York newspapers. Yet there is nothing new to labor men in the Green statement. Until Supreme Court Justice Cotillo handed down his decision there had never been any question as to the control exerted by an International over a chartered local. In sharp contrast to the opinion of Justice Cotillo is the expressed sentiment of Justice Hammer, of New York, who in hearing an application for an injunction restraining the Alliance from revoking the charter of Local 306, stated that it appeared to him strange indeed if an International which granted a charter to a local could not exercise full control over that local, even up to and including revocation of its charter.

The grave danger threatening the membership of 306 springs not from Alliance control but from the numerous court actions instigated by enemies of the Alliance. Alliance direction over Local 306 has been splendidly handled out of the General Office. Investigation discloses the fact that the 306 membership is enthusiastic about the control exercised by Harland Holmden, 7th vice-president of the Alliance, who is in immediate charge. Members of 306 never thought a union could be run on the economical, eminently fair and sensible basis established by the I.A. It is no secret that Holmden's first month in charge of Local 306 reflected a saving of more than $12,000 in operating expense—a fact which alone justifies Alliance intervention. Many members of 306 have voiced the hope that Holmden remain in charge of the Local indefinitely. So much for the charge made in court that the Alliance is "ruining" Local 306. It undoubtedly is "ruining" the Local for the grafters and for those who would bleed the membership white as chalk.

The New York situation is as long on potential tragedy—tragedy for the thousands of Alliance members—as it is short on humor. There, under the very noses of those who probably would welcome the disintegration of the Alliance, the organization is suffering incalculable harm. Buffeted about in the trade and the public press, with front-page stories and generous editorial space a daily occurence, the Alliance is taking a terrific pounding, its prestige, its affluence and influence damaged just so much more with every passing day. In addition to Kaplan, the Alliance must fight a dual union which rose to its greatest strength while Kaplan controlled Local 306, and it must fight in the courts for its right to control the destinies of Local 306, the bellwether unit of the I. A. and the

(*Continued on page* 25)

INTERNATIONAL PROJECTIONIST

VOLUME IV NUMBER 2

DECEMBER 1932

CURVES: THEIR STRUCTURE AND HOW TO READ THEM

Aaron Nadell

II

FIGURE 1 shows a comparison between three different incandescent lamps used for projection. Each curve shows the increase in brightness of the lamp as the wattage is increased. Plotting the three curves against one background makes it an easy matter to compare these lamps and to judge which of the three should be chosen.

The curves are labelled *A*, *B* and *C*. The legend at the top of the graph tells to which type of lamp each of these letters refers. The information appearing at the bottom of the graph reveals that the vertical lines represent wattage. The left-hand side of the graph shows that the horizontal lines stand for relative brightness, but in this connection the information given is somewhat obscure. The legend says: *relative* brightness This may mean that the figures, 10, 20, 30, 40, stand for percentages of some arbitrary standard of brightness. But there is no clue as to what that standard may be, nor to how the brightness was measured. The information given by this curve, therefore, is incomplete; still many valuable things can be learned from it.

According to this curve, *A* is by far the most desirable projection lamp, from the point of view of efficiency and economy. It may or may not have other drawbacks, but it certainly gives most light for the current it draws. At 200 watts it has a "relative brightness" of 17—whatever the 17 may represent, which this curve does not tell. To secure the same brightness from Lamp *B* requires 400 watts; from Lamp *C*, 600 watts.

This is easy to see from the curve. The lower end of curve *A* crosses the 200-watt line somewhere between the horizontal lines 15 and 20—at about the point where line 17 would be, if line 17 were drawn in. Now, moving horizontally toward the right with this imaginary line 17, it is easy to see that curve *B* crosses this imaginary line in the vicinity of the vertical line that represents 400 watts. Moving still further right, curve *C* is encountered at about the 600-watt vertical line.

The curve reveals many other things. One is that Lamp *A* is capable of yielding more light than either of the others, regardless of the power applied. At full power, 1,000 watts, Lamp *B* reaches a maximum relative brightness of about 27; Lamp *C*, at full power, barely manages to cross the horizontal line that stands for relative brightness 20. Lamp *A*, at full power, reaches a relative brightness of 38. At 250 watts Lamp *A* delivers as much light as Lamp *C* at 1,000 watts. (Lamp *A* crosses the 20-brightness line at 250 watts, Lamp *C* crosses it just as it reaches the vertical line that stands for 1,000 watts.) The curve for Lamp *B* reaches its highest point at the 1,000-watt line, where it reads 27 in relative brightness. Lamp *A* reaches the same height at about the 400-watt vertical line. Lamp *A* at 400 watts delivers as much light as Lamp *B* at the 1,000-watt mark.

Similar comparisons can be made between Lamp *B* and *C*. At 460 watts Lamp *B* reaches the same brightness that *C* attains only at 1,000 watts.

These detailed comparisons, although they are written into the curve and can be seen after a very short study of it, are of secondary importance. The chief information conveyed by this curve can be understood with the help of an almost instantaneous glance at the infor-

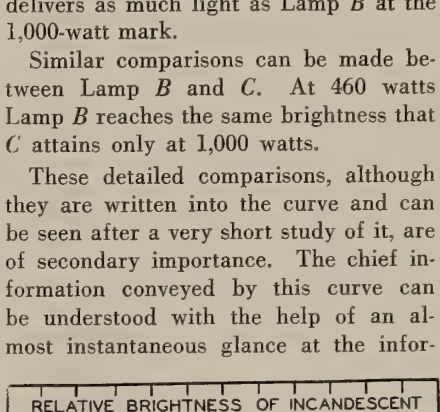

Figure 1

mation around the margins. It is that Lamp *A* is the best lamp, Lamp *B* the second best, and Lamp *C* the poorest, as far as efficiency and illumination are concerned. How long each lamp will last before it burns out is not shown by this curve.

Recording Voltmeter Curve

The three lamps are identified in the three lines printed along the top of the curve. Lamp *B* is shown to be a 50-volt lamp. At first glance this information might be mistaken to mean that Lamp *B* is a smaller lamp than the others, using less power, but the curve itself corrects any such mis-impression. The vertical lines, with the figures printed at the bottom of them, show that all three lamps are capable of being used at the same power; if Lamp *B* is a 50-volt lamp, then it obviously must draw a correspondingly greater amperage.

Figure 2 is a curve made by a machine —a recording voltmeter.

In many locations projectionists find that the meters installed on their amplifiers, or other parts of the projection room equipment, vary in reading from time to time. Sometimes they read so high that the apparatus is in danger of injury; sometimes so low that it is difficult to maintain the projection arc or keep the volume of sound as high as it should be. When it is suspected that variations in the line voltage delivered by the power company are responsible for such fluctuations, the power company will, in most cases, install a recording voltmeter upon request. Some recording voltmeters make a continuous record of the voltage over a period of a week. Some, as in the case of Fig. 2, require a new chart to be inserted in the instrument every 24 hours.

If a chart taken in this way shows the line voltage to be irregular, the power company sometimes can correct the trouble. Frequently the power company is not equipped to do so, and a voltage regulating device (there are several types now commercially available), must be installed.

The unusual appearance of the curve shown in Figure 2 results from the nature and construction of the machine that traced it. Once understood, this curve is quite as easy to read as if it were drawn against a rectangle, like the curve in Figure 1.

The recording voltmeter is similar to other voltmeters, except that, in place of an ordinary indicating needle, it has a somewhat heavier indicator that carries a pen at its far end. Also, the recording voltmeter is equipped with a clock-work which (in the case of the chart shown in Figure 2), causes a circular disc to make one complete revolution in 24 hours. The paper chart is screwed down

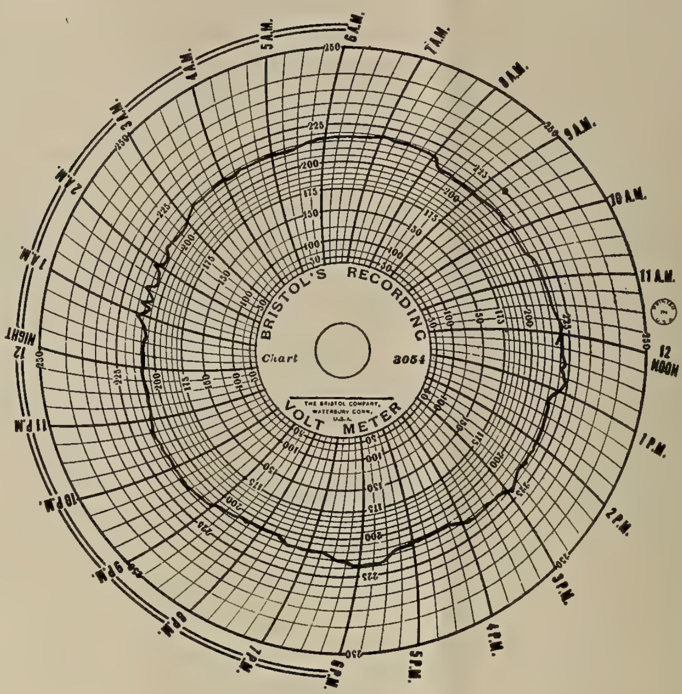

Figure 2

upon the disc, and the pen traces the line of the curve as the disc revolves.

In an ordinary voltmeter, the position of the indicating needle changes as the voltage changes. In this case, it is the position of the pen that changes when the voltage fluctuates. The curve in Figure 2 shows that the highest voltage attained was 225 to 12.46 p.m., the lowest, 205, volts at 8 p.m.

Structure of the Curve

In this chart the curved lines radiating outward from the center represent hours of the day. These hours are printed around the edges of the chart. Hours of darkness are shown by the double curved lines, at the outside edge of the chart, which connect one hour with the next. Voltage is represented by the circular lines. At a number of places around the chart some of these circles are interrupted to allow room for figures that tell what voltage each of them represents. This curve, because of its circular nature, and especially because the lines that radiate outward from the center are not straight, sometimes gives rise to a trifling, momentary confusion. But the necessity for its peculiarities is easy to understand.

Another peculiarity of this chart is that the circular lines representing voltage are not equally spaced. The 25-volt space between 50 and 75 volts is compartively pinched. The 25-volt space between 225 and 250 volts is quite wide. This peculiarity again traces back to the nature of the recording instrument, and can best be understood with the help of a glance at Figures 3 and 4.

Figure 4, in contrast to Figure 3, shows a meter on which the scale readings are irregularily spaced, exactly as the voltage lines in Figure 2 are irregularly spaced. The recording volt-meter that drew the curve in Figure 2 was then, obviously a meter of the type show in Figure 4. If the meter were of the type shown in Figure 3, the spacing of the voltage lines would be more orderly. If the projectionist will examine the meters in his own projection room he will very likely find that he has some of each of these two types of construction and scale-spacing.

From the above it can be seen that the chart of Figure 2 differs from any other curve only in those peculiarities required by the nature of the machine that drew it. It would be quite easy to redraw Figure 2, by hand, upon a perfectly regular, rectangular background, and the reader may try the exercise if he cares to. But it is just as easy to read Figure 2 directly as to redraw it. It is easier to read on the original chart than on this printed page. In the present case the entire magazine must be turned around, or the numbers read upside down. The small circular chart is easily spun around for convenience in reading.

Reading the Curve

The curve overlaps itself at the noon line, indicating that the needle was placed on the chart exactly at noon, and removed at 12.12 p.m. the following day. The voltage when the record started was about 222, rising twice to 225. At about 10 minutes to 1 it dropped away, and reached 216 or 217 at about 1.10 p.m. Apparently factories in the neighborhood had cut off their power for the noon

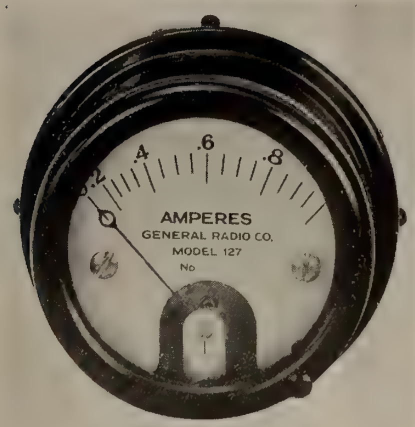

Figure 3

lunch-period, and started their machines again as 1 o'clock approached. There is a five-volt jump in the chart close to 3 o'clock for which it is difficult to supply any explanation. The voltage sinks between four and five to a low of 210—factory machinery running full blast and some factory lights being turned on, apparently. At 5.30 the voltage rises quite sharply to about 219, but shortly after that home lights and street lights are turned on, and there is a low of 205 volts at 8 p.m. Thereafter the voltages rise again until 11 p.m., where there is another drop, perhaps indicating that a power-house generator has been cut off for the night. Between one and two in the morning there are some sharp fluctuations that seem to indicate a lightning storm not too far away. The voltage increases by 5 volts for reasons unknown between 3 and 3.15 a.m. There is another rise beginning shortly after 5 a.m. as street lights are turned off and additional generators added to the circuit. The power reaches a peak of 220 just before 8 o'clock and drops sharply as the factories go back into operation. The voltage increases further, for unknown reasons, between 10.30 and noon. When the needle is removed from the chart, the voltage is slightly lower than it was the same time the day before.

This chart shows a maximum difference in voltage of 20 volts, from 225 at 12.45 to 205 at 8 p.m. It shows more than that. It indicates that in most cases the fluctuations shown are traceable to definite changes in the external load, and that the power company probably will not be able to provide better regulation without greatly increasing its equipment. Still more than that is revealed by the chart. The changes in voltage that are traceable to outside causes are such as are likely to recur at the same hours each day. A manually operated voltage-control device will therefore probably be adequate if the projectionist will remember to re-adjust it at the appropriate times. Except for the distant thunderstorm during the early hours of the morning, there seems to be nothing that requires the additional expense of an automatic voltage control. Lastly, since the maximum fluctuation is 20 volts on a 220-volt line, equivalent to 10 volts in a 110-volt line, it is quite possible that whatever projection room trouble may have been experienced is not traceable at all to this comparatively reasonably variation in supplied power but is due to some defect in the theatre's own equipment, which, according to the nature of the trouble experienced, may quite possibly be due for re-inspection.

Any further lingering uncertainties that may possibly have been created by the slightly unusual background of the curve in Figure 2 can be cleared up by redrawing this curve, as explained, against the commoner, rectangular background.

(*To Be Continued*)

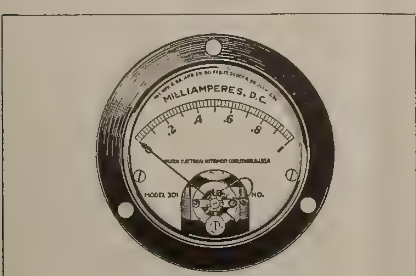

Figure 4

NOISE SOURCES WHICH AFFECT SOUND REPRODUCTION

Of outstanding importance to the refining process of sound motion picture reproduction in the theatre is the study of extraneous noise sources which materially affect reproduction quality. A comprehensive survey of such noise sources is reflected in the paper "Theatre Noise Sources," by Messrs. Wolf and Tweeddale (of Erpi), which was presented at the Spring, 1932, Meeting of the S.M.P.E., an abstract of which forms the basis for the accompanying article.—Editor.

THEATRE noise sources may be divided into two general classes: those external to the theatre, and those within the theatre and incidental to its operation. Primary among noises produced exernal to a theatre are those of street traffic, industrial establishments, and railway or other forms of transportation. . . .

Noises of internal origin arise from projection machines, ventilating or air conditioning apparatus, and from house service or other operating equipment. The noise from such sources may be transmitted through the air directly, or through the structure that houses the apparatus. In addition, vibrations from such sources may be transmitted directly into the structure of the building, and may be transformed into noise at points remote from the apparatus causing it. Both air-borne noise and vibrations can be minimized by applying correct precautionary measures.

The noise created by projection equipment is of most immediate interest due to the great frequency with which noise problems involving it has been encountered. The term "projection equipment" is meant to include the projectors, generators, monitors, rewinds, and such other devices that are part of or accessory to the projection of motion pictures and the reproduction of sound. The noise created by the projectors is of the most immediate interest.

The method of reducing noise is either to select quiet equipment or to construct projection rooms that will confine both the air-borne noise and the vibration to the area immediately surrounding the source. This necessarily implies that the projection room be adequately insulated. Measurements of noise level in representative projection rooms have indicated that the noise level varies between 55 and 65 decibels, *or even higher when the equipment is badly worn.* It has been found that projection room structures should be capable of attenuating the sound to the extent of 45 or 50 decibels if an appreciable disturbance is not to be created. This is particularly true of projection rooms that are located immediately adjacent to choice seating areas in the theatre.

The success attained in so constructing walls as to be effective acoustical insulators depends not only upon the selection of materials and the design, but also upon paying meticulous attention to such details as projection ports and doors. The glazing of the projection ports and the construction of the door should be such as to provide insulation equivalent to that of the wall structure in which they are used. Apparently minor, direct openings that permit the transmission of air-borne noise will vitiate an entire sound insulative wall construction.

To illustrate, consider an exposed wall surface, 10 by 20 feet, constructed of six inches of clay tile, plastered on both sides. From laboratory data, this structure should reduce the transmission of sound by approximately 44 decibels. Suppose that ports totaling eight square feet in area, glazed with a single thickness of ¼-inch plate glass, were placed in this wall so that no direct leakage occurred around the glass; the sound transmission of the structure would in such a case be reduced to approximately 41.5 decibels. To carry the illustration one

(*Continued on page* 29)

NEW RCA POLICY FORECASTS 'WIDE OPEN' FIELD

Outright Sale and Abolition of Compulsory Servicing Brings Relief to Exhibitors and Provides Splendid Opportunity for Alliance Control of Servicing

COMPLETELY reversing the time-honored policy of sound reproducing equipment manufacturers, RCA Victor Co., through its Photophone Division, has announced the abolition of compulsory servicing on its latest "High Fidelity" equipments. Instead of licensing for a ten-year period as heretofore, the RCA Victor Co. has adopted a policy of outright sale, the elimination of contract service as soon as the apparatus is fully paid for, and further reduction of contract service in cases of deferred payments.

Announcement of this new policy created a sensation in the sound picture field and precipitated a torrent of discussion, argument and speculative comment as to its effect within the industry and its bearing upon the position of Electrical Research Products. Inc.. which has by far the bulk of the installations throughout America.

Ever since sound pictures replaced the silent screen. manufacturers of reproducing apparatus have leased their equipment to exhibitors for a period of ten years. Some companies also required the exhibitor to accept periodical service at specified rates for the entire term of the contract. In 1929, RCA Photophone revised its service policy so that in no case was an exhibitor required to accept service for more than three years, and last year, in addition to making a marked reduction in contract service charges, made the maximum period two years on the larger sizes and one year on the smallest.

The RCA announcement stated in part: "It is the Company's conviction that this new policy will be highly acceptable to all exhibitors. Under its provisions, once the terms of the contract are met, whether they provide for cash or deferred payments, *the equipment belongs to its purchaser. Service will be optional with him.* Our experience leads us to believe that, at our very reasonable rates, he will want regular service, *but he does not have to take it.* In this connection, to protect and supervise our property, we make one necessary reservation—under the deferred payment plan. When deferred payments cover a one-year period, six months' service is required. Under the two-year plan, one-year service, and under the three-year plan, eighteen months' service. We specify periodical scheduled calls, averaging from one to two calls per month, dependent upon the type of equipment. Of course, we always stand ready to render

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The I. A. and the Servicing of Sound Equipment

An Editorial

ANNOUNCEMENT by RCA Victor Company of the abolition of compulsory servicing for its sound motion picture reproducing equipments in theatres poses a very interesting question and one that merits the immediate serious attention of all officers of I.A. projectionist unions. This question is: "If other companies should follow the lead of RCA Victor Company and abolish compulsory servicing, why should not the various local unions of the Alliance offer sound equipment servicing operations as an integral part of their service to theatres?" A logical answer, as we see it, would be: "They should."

There really is nothing new or startling about this suggestion. For several years the International Alliance has been preparing itself to assume the responsibilities of servicing sound equipments in theatres. Nothing definite looking toward the assumption of this work has been done for two reasons: (1) the extremely cordial relations existing between organized labor and the major sound equipment companies, and (2) the realization by a majority of Alliance and local union officials that their men in the field were unprepared for sound system servicing. Of these two reasons, the first probably was the more important.

But now, entering upon 1933, there is ample evidence at hand that existing servicing policies will be greatly liberalized, and it cannot be denied that Alliance members have demonstrated their ability to handle this type of work.

Assumption of sound picture equipment servicing by Alliance members should not be considered as being an aggressive move; rather it is a purely defensive move and one calculated to protect the priority in theatre work established and enjoyed by Alliance members over a period of years. It is common knowledge that the ranks of dual unions have been swelled appreciably by former sound equipment service men who, once cut loose from their jobs, lost no time in capitalizing the knowledge gained through weekly visits to projection rooms over a period of years.

It is generally understood that during the past four or five years sound equipment service men learned more about visual projection work than the visual projectionist

emergency service at rates currently maintained by our installation and service department."

Announcement also was made of the prices of the new 'High Fidelity" series of sound reproducing equipment, as follows: Standard Super Size, $5,500; Standard Large Size, $4,100; Standard Small Size, $2,750; Special Size, $1,650.

Many industry leaders professed to see in the RCA Victor action a forerunner of the abolition of compulsory servicing operations by all sound equipment manufacturers, irrespective of trade mark. Robert Robins, Executive Secretary of the American Society for the Protection of the Motion Picture Theatre, Inc., an organization formed for the announced purpose of protecting the "freedom of the arts and sciences in their relation to the motion picture theatre," viewed the RCA Victor move as the "first step in a series of events which within a very short time will see the complete passing of compulsory servicing contracts and will see the motion picture industry returned to those who through the years have contributed most to its development —the producer, the exhibitor and the labor man."

Law Suits a Factor

Some observers were inclined to view the action of RCA Victor as being anticipatory to the decision now pending in the matter of the suit of Duovac-Warner-General Talking Pictures Corp. vs. Erpi, the taking of testimony having been completed recently at Wilmington, Delaware. Heavy damage claims on the part of the plaintiffs are incident to this suit, a factor which is seen by some observers as tending to prevent any radical change in the present Erpi servicing policy.

Once this matter of compulsory servicing is adjudicated, either through a decision or through settlement, according to well-informed opinion, it is possible that servicing operations will be placed on a "wide open" basis, with the exhibitor being in the position where he may pick that type of service he prefers.

Projectionist local unions of the International Alliance are following closely developments in the servicing field and are reported to be perfecting an alignment of manpower preparatory to any radical change in the service policy of the major sound equipment manufacturers. The unions seem to be fully aware of the fact that until such time as the existing servicing contracts are voided no action can be taken looking to assumption of servicing operations by their members.

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learned about sound equipment. It is ridiculous to assume that this comparatively brief weekly contact with professional projection work enabled any service man to qualify as a competent projectionist; but the recruiting drives in behalf of various dual uuions accorded very little recognition to the question of competence. Everybody and everything in the dual union set-up was subordinated to one thing—price.

Outsiders in Projection Rooms

First and foremost in the lineup of factors which favored the progress of dual unions was, and still is, the wide open licensing situations existing in every state. More anon about this. But running a close second in importance to the licensing set-up was, and still is, the large number of footloose ex-servicing men, the availability of whom was a vital factor in the sudden and widespread activity by dual unions. It is with this thought in mind that we say that any move on the part of Alliance local unions to corral servicing work must be classified as a purely defensive one. Let us be done with those conditions which permit a steady stream of outsiders in and out of projection rooms.

There are two things to be considered by local union officers in connection with sound equipment servicing. First and by far the most important consideration is *immediate action* on the part of the Alliance generally and every local union in particular looking toward the selection of their outstanding man or men to whom, if necessary, may be given further training to insure their competence for the particular job of sound equipment servicing. To have servicing work dumped into one's lap, so to speak, and then be unable to grasp such an opportunity through unpreparedness is unthinkable. The second point which it is desired to emphasize is that no move should be made to secure this type of work for Alliance members until definite action is taken by sound equipment companies with respect to either the abolition or liberalization of existing servicing contracts and policies.

To ignore this latter consideration would be to invite serious trouble not only for the individual local union but for the Alliance as a whole. *Under no circumstances* should any local union attempt to secure servicing work without first making sure that there exists no legal instrument the disregard for the terms of which might result in a damage suit the effects of which possibly would be disastrous to the local union. When and if compulsory servicing is either abolished or the terms of existing agreements greatly liberalized, then and *then only* should a local union take the necessary steps to secure this work.

Ample Servicing Desirable

So that there may be no misunderstanding of the position of INTERNATIONAL PROJECTIONIST relative to this matter, it may be said that in no sense are these words designed to be inflammatory or to embarrass any sound equipment manufacturing company in the conduct of its business as it sees fit. INTERNATIONAL PROJECTIONIST, fully aware of the great harm done by the senseless neglect of visual projection equipment, is on record as favoring ample servicing operations for sound equipments. We are not seeking to excuse our present attitude when we state that INTERNATIONAL PROJECTIONIST is the only publication within the industry which has had the courage to discuss the servicing situation, its previous remarks relative to this topic[1] standing today as the outstanding contribution to the subject and constituting the only impartial favorable treatment of the topic of ample servicing operations.

The pressing question of the moment, as we see it, is not whether there shall be servicing but, rather, who is to handle the servicing work.

Decision Rests With Exhibitor

RCA Victor Company has announced the abolition of compulsory servicing with respect to its new "High Fidelity" reproducing equipment. The Company will continue to maintain a servicing organization which will render service at prevailing rates. The Company explicitly points out, however, that once the equipment is paid for in full, service is elective on the part of the exhibitor. This means that the decision as to servicing rests wholly with the ex-

[1] "The Question of Service for Sound Systems," by James J. Finn. July, 1932, p. 14, Vol. 3, No. 1.

THE WHAT, WHY AND HOW OF SOUND VACUUM TUBES

James J. Finn

III. Light-Sensitive Cells

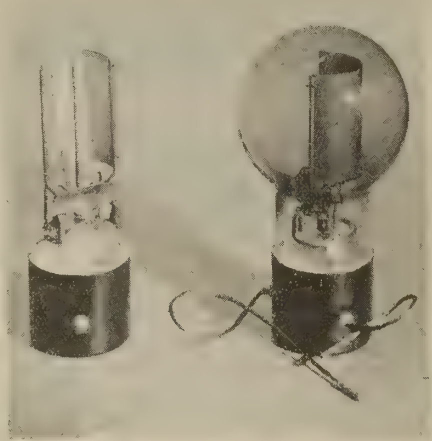
AN essential step in the reproduction of sounds recorded on film is the conversion of the different values of light and shade, by which the sound is represented on the sound track, into corresponding variations in the strength of an electric current. This conversion is performed by means of the device known as the photo-electric cell, whose basic property is that it gives an electrical output which depends on the amount of light to which the cell is exposed. If the light fluctuates in intensity, as it does after it has passed through a moving sound track, then the electrical output of the cell will, of course, have the same frequency as this fluctuation.

Photo-electric cells can be divided into three classes: photo-conductive, photo-voltaic, and photo-emissive.

The best-known form of photo-conductive cell is that which uses selenium. This metal has the property of changing its resistance when light falls upon it. The action of the selenium cell is sluggish, which means low output at the higher frequencies, and, moreover, its response is not proportional to the light falling upon it.

In the photo-voltaic cell an *E. M. F.* is produced between two electrodes under the influence of light. It therefore requires no polarizing voltage. The cathode usually consists of a copper plate coated with cuprous oxide, while the anode is made of a strip of lead, the electrolyte usually being a dilute solution of lead nitrate. It is a low impedance cell, and at its present stage of development its life is uncertain. Its output is not proportional to illumination, and at the higher frequencies is even poorer than that of the selenium cell.

In photo-emissive cells, electrons are liberated from a light sensitive cathode under the influence of light. As the illumination is changed, the current due to the electron emission changes in exact proportion, or, in other words, the illumination-current relationship of the photo-emissive cell is rectilinear. This is a valuable characteristic not possessed by other types. It is also free from another drawback of the photo-conductive and photo-voltaic types, namely, decrease of output at the higher frequencies. This type of cell is the one adopted for sound picture and picture transmission work, in view of its superiority for these purposes.



W. E. 3—A Photo Cell

P. E. Cell Development

The first clue that led to the development of the photo-electric cell was found by Hertz, who was also the pioneer experimenter with the electric waves which form the basis of radio today. He found in 1887 that ultra-violet light falling on the electrodes of a spark gap facilitated the sparking discharge. We know today that this was because the illumination released charges of negative electricity from the illuminated surface, in the shape of electrons.

In 1889 Elster and Geitel discovered that the alkali metals, such as sodium, potassium, rubidium and caesium, gave relatively large electron emission under exposure to light. These two investigators also discovered that when a glow discharge was passed through hydrogen gas which had been introduced into a potassium cell, the light sensitive surface was changed to potassium hydride and became one hundred times more sensitive than the pure metal.

A further fundamental discovery was that if a small amount of a chemically inert gas was introduced into the cell, such as helium, argon or neon, the photo-electric current was increased very materially. This was explained later as being due to the action of the liberated electrons from the cathode colliding with the gas particles, thereby liberating other electrons, which in turn were included in the electron stream to the anode. Gas particles that had lost their electrons by collision were thereby given a positive charge, which facilitated the negative electron passage by making the path to the anode slightly positive. These beneficial effects are known as *gas amplification.*

Further study of the light sensitive alkali metals indicated that more sensitive cells than those using potassium should be obtained if rubidium or caesium were used in the place of potassium. Difficulties occurred, however, when it was discovered that rubidium and caesi-

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hibitor, the same as it does for projection labor, and with this status we are wholly in accord. If servicing operations be declared a "wide open" field of endeavor, it seems to us, therefore, that there is no apparent valid reason why the various local unions within the Alliance should not make a serious bid to assume these duties.

In conclusion we desire to iterate two factors which we consider to be all-important: (1) the need for *immediate action* on the part of local unions in preparing themselves for servicing sound picture equipments, and (2) the necessity for making absolutely certain that there exists no legal instrument which will conflict with the unions' activities in this direction. Once such existing agreements are cancelled out, (and we can offer no guarantee that this will be done), then the unions can proceed vigorously with the campaign of organizing servicing operations. This last point is extremely important.

Irrespective of any other consideration, however, there is absolutely nothing to prevent preparedness by a local union along the lines previously set forth, and it could do no harm if exhibitors, the unions' customers, were acquainted with the fact that when the proper time comes the union stands ready and willing to do an efficient servicing job. JAMES J. FINN.

um would not lend themselves to the hydrogen gas treatment found so beneficial with the potassium cell. However, a satisfactory method of increasing sensitivity was finally found in the formation of a photo-electric surface containing caesium, oxygen, and silver.

The W. E. 3-A Cell

The foregoing brief outline of the history and theory of the photo-emissive cell will enable us to better appreciate the significance of the various features of the cell which is now used in Western Electric sound picture apparatus.

This cell, coded as the 3-A, employes a caesium-oxygen-silver surface as the photo-emissive element, superseding an earlier design, the 2-A, which used potassium hydride. The light sensitive element, or cathode, is the semi-cylindrical member which is visible in Figure 6. This part is made of silver which is oxidized and then coated with caesium. The electrons emitted from the cathode are collected by the small straight nickel rod, called the anode, which stands at the axis of the cathode. A 90-volt positive potential is applied to the anode, polarizing it so that the electrons emitted by the cathode stream over to it in the same way that they flow from the filament to the plate of a vacuum tube. The tube is gas-filled, that is, the air is first pumped out, as in a vacuum tube, and then a small quantity of carefully prepared argon is admitted. The increased efficiency mentioned as due to gas amplification is thereby secured.

Photo-electric cells vary widely in their responsiveness to light of different colors, or wave-lengths. Some, for example, are most sensitive to blue, and as light of this wave-length forms only a small part of that emitted by exciting lamps of the kind now in use, such cells are relatively inefficient for use in sound equipment. The Western Electric 3-A photo-electric cell, on the other hand, is most sensitive in the red and infra-red region, which includes the greater part of the luminous energy given off by the exciting lamp. Hence, it is very efficient in its use of the light which comes to it through the sound-track.

Some types of photo-electric cells suffer considerable deterioration with age, even if not in use, being especially effected by warmth. The 3-A cell is practically immune to deterioration when stored at any temperature up to 150° F.

The frequency characteristic—that is, the amount of output given under the stimulus of various frequencies recorded on the sound-track—is a most important feature of any cell intended for sound picture use. If the cell output varies with different frequencies, it is likely to introduce distortion and cause a deterioration in the quality of the reproduced sound. The response of the 3-A cell is uniform over a frequency range much wider than that now used in sound picture work.

RCA CONSTANT SPEED DRUM INSURES UNIFORM FILM MOTION

THE system of sound pictures utilizing a sound track on the picture film has been criticized and objected to by many sound picture engineers because of the difficulty of securing a steady motion of the film past the sound scanning light or point of sound take-off.

Some of the largest producing companies were very reluctant to change from disc records to sound-on-film because of the superiority of the disc record in respect to freedom from flutter, rasp, etc., that has been present heretofore in sound reproduced from film. Some of these producers have continued to employ disc records for the original recording of music and have re-recorded to film for release, thus avoiding the distortion that accompanied the re-recording from a film to the final release negative.

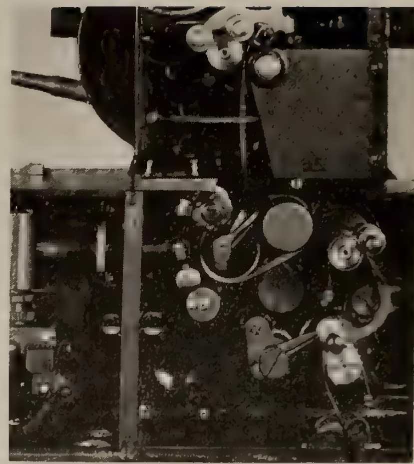
Relation to 'Highs'

Since it has been possible to record a wider frequency range on film, the one serious defect in reproduction had to be overcome to make this improved frequency range practical and to realize an improvement at all in the reproduction as heard in the theatre. It would be futile to increase the frequency range without eliminating the flutter and rasp due to the irregular motion of the film when scanned, while being pulled through friction gates or equivalent devices by sprockets engaging the perforations.

Other Advantageous Features

Continuous research on this problem has been conducted in the RCA Victor laboratories and this work has resulted in a new principle, which has been termed a Rotary Stabilizer, or film-moving mechanism, that imparts to the film sound record the same desirable characteristics that are possessed by the disc record. While the film is being scanned by the sound beam it is securely held in contact with the surface of a rotating steel drum so that effectively the film becomes a part of a system possessing mass and capable of being controlled by the new Rotary Stability to insure a smooth rotation of the drum carrying the film, independently of sprockets, gears or driving system.

This development makes possible the realization of the improved reproduction to be expected from the "High Fidelity" recording.



Showing path of film travel and constant speed drum in new RCA head

In this new soundhead are other features designed to reduce maintenance cost and to insure reliable performance free of interruptions. The motor for driving the projector and soundhead is mounted as an integral part of the soundhead and drives through a worm gear cut on the motor shaft and running in oil. This eliminates exterior high-speed gears, belts, or chains, resulting in very quiet operation. A handwheel for the outer end of the motor shaft provides an easy means for the projectionists to turn the projector to check threading, etc.

For Simplex Only

All running bearings are of the ball type. There are no bushings to wear out. The optical system is oil proof and all exterior lenses of the system are accessible for easy cleaning. Threading is extremely simple and there is adequate space for the projectionist to work during threading operations.

This soundhead attachment designed for mounting only with Simplex projectors, utilizes a greatly improved arrangement consisting of a rotating drum, to replace the former sound gate, mounted on a shaft having a very light hollow case on the outer end, the whole running on ball bearings. Inside the hollow cylindrical case is a flywheel concentric with the shaft but running on a ball bearing so that it is entirely free to rotate about the shaft. The remaining space inside the case is filled with a suitable oil, which through its viscosity sets the flywheel in motion when the hollow case on the shaft rotates and also acts to damp out oscillations which, were the flywheel connected to the shaft, would occur in the motion of the drum. This soundhead will not vary in performance due to the condition of the film.

PROJECTOR DISTRIBUTION

An agreement has been signed recently in Leipzig, Germany, between the Philips Concern and the German Nitzsche A.G., according to which the former is to handle the export and foreign sales of a new cinema projector "Matador" turned out by the Nitzsche A.G. in nearly all countries of the world.

SHORT FOCUS LENSES FOR REAR PROJECTION

Wilbur B. Rayton

SCIENTIFIC BUREAU, BAUSCH & LAMB OPTICAL COMPANY

PROJECTION from behind a translucent screen appears to have advantages in small theatres designed to be operated in low-rental premises and with a minimum of operating staff; and also in larger theatres, where it permits stage effects that are impossible by any other means.

To realize these advantages, however, the projection distance must be much smaller than is common in the conventional type of projection for a picture of the same size. For this purpose lenses have been developed, with a focal length as short as one inch, that project 35-mm. film with satisfactory image quality. The optical requirements are rather difficult to meet. For a projector aperture of 0.600 × 0.825 inch, the field of view amounts to about 54 degrees, four times as much field as is required of a 4-inch focus projection lens. At the same time, the relative aperture customary in projection lenses must be maintained in the interest of attaining a sufficiently bright picture. Furthermore, in view of the large angular field, it is necessary to avoid the considerable reduction of diameter of the light concerned with imaging the margin of the field, common in photographic lenses, an expedient that makes the problem of the designer of photographic lenses somewhat easier.

The projection screen is probably no less tolerant of a variation of illumination from center to edge than the photographic film, but other factors contribute to cause so great a reduction of marginal illumination when using lenses of this kind that the reduction due to the projection lens must be held to a minimum.

† S.M.P.E. *Journal, December*, 1932

These requirements make the problem of design one of unusual difficulty if approached in the usual way. It has been generally understood throughout the motion picture industry that the problem has been solved, but it has not been known just how it has been accomplished. There has been, in fact, a vague impression of mystery about it, and a mild curiosity as to wherein these lenses differ, if at all, from ordinary types of projection lenses. Patents granted in this country and in England during the past year disclose a method of attack that seems to have engaged the attention of several people simultaneously.

All these patents[1] have one feature in common, *viz.*, the use of a divergent or negative lens in front of, and separated by some considerable distance from, a converging rear component which is generally a projection or a photographic lens of some well-known type. In general, the whole construction resembles, in some degree, an inverted telephoto combination.

The optical advantage of such a combination is twofold. In the first place, it leads to a longer back focus than is obtainable in a singe lens or a conventional type of projection lens of the same equivalent focal length. The second advantage is significant only to the lens designer and, briefly stated, lies in the fact that such a combination permits the attainment of satisfactory image quality over a larger angular field of view than appears to be attainable with ordinary construction when, at the same time, a high relative aperture must be attained.

[1] REFERENCES:
U. S. Patent 1,802,099, granted April 21, to W. G. Wolfe.
Br. Patent 348,123, granted May 1, 1931, to Translux Daylight Picture Screen Corp.
Br. Patent 247,946, granted May 7, 1931, to Technicolor Motion Picture Corp.
Br. Patent 355,452, granted August 27, 1931, to H. W. Lee.

The optical principles involved are immediately apparent to the optical expert, but since only relatively few persons have occasion to study optics intensively, it may not be amiss to outline briefly the theory involved so that it may be comprehended how these advantages are realized.

Assuming a combination of two simple lenses, one a negative and the other a positive lens with the negative lens lying between the object and the positive lens, we may distinguish three cases of interest. These are represented in Fig. 1. In Fig. 1 (*a*), the negative lens lies between the positive lens and its first principal focus. In this case the equivalent length of the combination is greater than that of the positive lens, and the back focus of the combination (distance from lens to image) is greater than that of the positive element.

In Fig. 1 (*b*), the negative element lies in the first principal focus of the positive lens. Here, the equivalent focal length of the combination is exactly equal to the focal length of the positive element. The negative lens has no effect, therefore, on the ultimate size of the image. The back focus of the combination is shorter than in Fig. 1 (*a*), but is still longer than that of the positive lens alone.

In Fig. 1 (*c*), the negative lens is separated from the positive by a distance greater than the focal length of the latter, and this is the case in which we are interested, for here the equivalent focal length of the combination is less than that of the positive lens. The back focus, on the other hand, is still greater than that of the positive lens, although shorter than in either Fig. 1 (*a*) or Fig. 1 (*b*). The first of the two advantages claimed

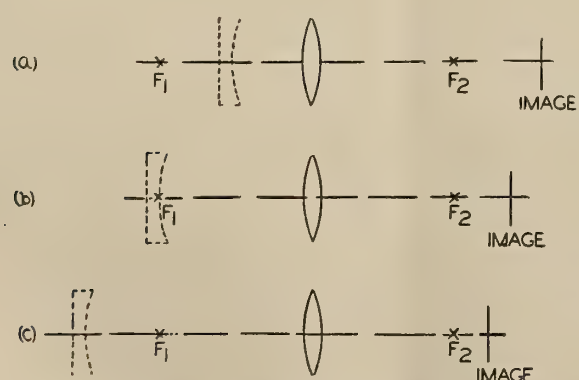


FIGURE 1

(a) Combination of positive and negative elements separated by a distance shorter than the focal length of the positive lens; equivalent focal length of combination greater than focal length of positive. (b) Separation equal to focal length of positive; equivalent focal length equal to focal length of positive. (c) Separation greater than focal length of positive; equivalent focal length less than focal length of positive. (In all cases, the back focus is greater than the back focus of the positive lens.)

for the combination is here apparent.

Fig. 2 is designed to show in a crude way how the second advantage is realized. The simple positive lens of Fig. 1 has been replaced by a lens of the Petzval type. At the left is represented a motion picture aperture, the edges of which are connected by lines representing the principal rays of the pencils to the second nodal point, H_2, of the lens. The enclosed angle, $2w_1$, is the angular field of view. These principal rays leave the lens as though they diverge from the first nodal point, H_1, and proceed toward the screen within the same angle, $2w_1$. Falling on the negative lens, however, they are further diverged so that they enclose the larger angle, $2w_2$. It is obvious, therefore, that the projected picture is enlarged by the introduction of the negative lens.

It is realized that this is utterly inadequate as an exposition of the optical principles involved, and yet no more is needed to establish a basis on which to call attention to the one interesting feature. If we have at our disposal a lens whose maximum useful field of view is of some finite value such as $2w_1$ in Fig. 2, a combination whose covering power is appreciably greater can be obtained by adding a negative element in the manner we have been discussing.

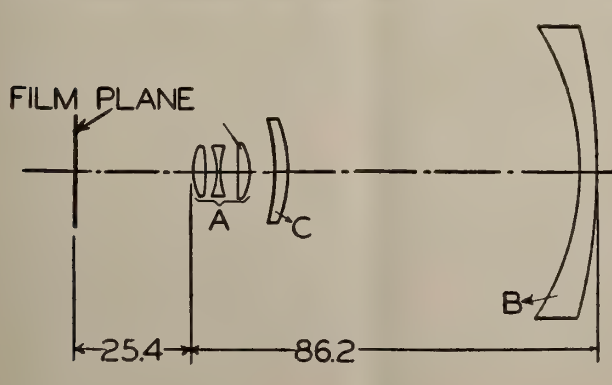
Quality of Image

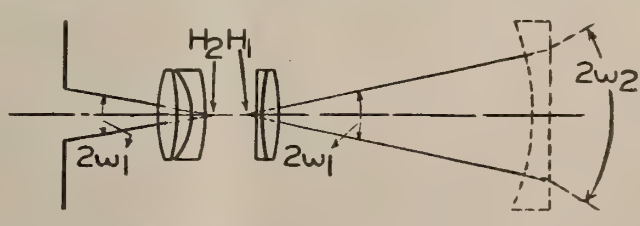
Now, in spite of the fact that the elementary theory indicates that this system would perform as indicated, there is no reason to assume that the quality of the image would be satisfactory. Fortunately, if one is content with a reasonable increase in size of field, a negative lens of relatively low power suffices, and many of the aberrations of even a simple negative lens are of such a sign as to compensate for the inevitable residual aberrations of a high-speed positive projection or photographic objective. It cannot be said, however, that the final result is entirely satisfactory if a simple negative lens is used when the increase in field sought is great enough to make it of interest. As a matter of fact, a simple negative lens used in this manner will inevitably introduce a cushion-shaped distortion when the combination is used for projection and barrel-shaped distortion when it is used for photography. For this reason all the constructions shown in the patents[1] referred to previously disclose more or less complex negative elements; and many of the specifications, as well as most of the claims, are concerned with specific constructions proposed as means for overcoming distortion and other aberrations. Claim (1) of the British patent 347,946 issued to Technicolor Motion Picture Corp., and claim (1) of the British patent 348,123 issued to Translux Daylight Picture Screen Corp., as assignees of Lester W. Bowen, cover rather broadly the basic combination for a photographic and a projection lens, respectively. They were granted just a week apart. In addition to these patents another was granted to Wolfe, U. S. patent 1,802,100, on the same day as patent 1,802,099, disclosing another form of the negative element.

These various solutions of the problem employ in some case aspheric surfaces; in others, compound constructions in which aberrations are eliminated in the customary way by suitable choice of glasses and shapes of lenses; and in still others, aberrations are purposely introduced into the positive lens of such a character as to compensate for those of the negative element.

The writer has found another method of attacking the problem that gives very satisfactory correction of distortion as well as of the other aberrations with very small optical effort. The method is based upon a consideration of the elementary laws governing distortion in lenses. Any simple lens working in combination with a diaphragm at some distance from it will exhibit distortion. Examples of such combinations are the simple meniscus lenses with the diaphragm in front of them, as used in cheap hand cameras. The magnitude of the distortion depends on many factors, such as the distance from the diaphragm to the lens, the focal length of the lens and its shape. The sign of the distortion depends upon the nature of the lens, whether convergent or divergent, and on the position of the diaphragm relative to the object and the lens. In hand camera practice, if the diaphragm is in front of the lens the photograph will exhibit barrel-shaped distortion, while if the diaphragm is placed behind the lens, the distortion will be cushion-shaped.

In view of these facts, it seemed possible that the distortion introduced by the negative element, which, in such a combination as is under discussion, must operate in effect as though with a diaphragm between itself and the film, could be compensated for by adding a positive element between the negative lens and the diaphragm, without losing all the advantages inherent in the application of the negative lens. The experiment was successful, and Fig. 3 discloses one form of construction to which this method leads. In this construction *A* represents a completely corrected self-contained lens, in this case a triplet; *B* is a simple negative lens, and *C* is an additional simple positive lens. Since both *B* and *C* lie on the same side of the diaphragm plane or crossing point of the principal rays, the distortion due to each is opposite in sign; and since, by approporiate selection of focal lengths and separation, the amount of distortion due to each may be made identical, the combination can be made completely orthoscopic. Other aberrations also tend to compensate, so that by an appropriate choice of shapes for *B* and *C*, astigmatism and coma can be disposed of. The lenses are nearly of the same focal length, and therefore the Petzval condition for flatness of field is reasonably fulfilled and a proper choice of glasses leads easily to chromatic correction. The lens illustrated in Fig. 3 has an equivalent focal length of 25.6 mm. and a relative aperture of $f/2.8$. This lens will therefore produce nearly as bright an image for a picture of given size as the average projection lens, as it has a relative aperture nearly as great as the latter. The speed of the combination can easily be increased by beginning with a positive lens of higher speed. This particular construction, however, has the merit that it contains no cemented surfaces and a number of air-





(Left): *Fig. 3. Construction of a new form of lens of 1-inch focal length giving excellent definition on 35 mm. film.* *(Right)*: *Fig. 2. How a negative lens element operates to increase angular field of view*

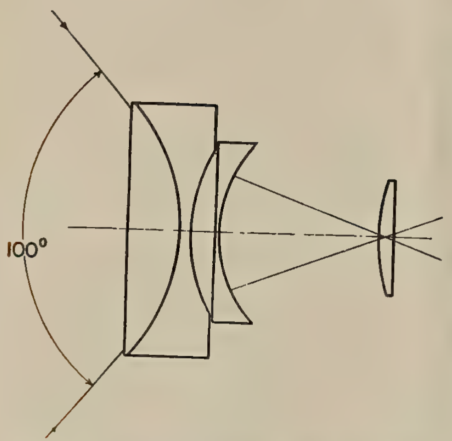


Fig. 4. Negative element used as the first lens of a submarine periscope in 1915 to cover a field of 100°

glass surfaces that are reasonably small in view of the requirements to be met.

It should be evident that there are limits to the increase of field of view that can be expected from efforts so slight. The same fundamental principle can be employed, however, in more elaborate constructions, wherein both the added negative and positive elements may be made compound.

It is interesting to note that the application of a negative lens as the first element of a system of which a large field of view is required has been well known to optical designers for a long time. Without having made any effort to trace its history, I can mention the fact that I employed the device in submarine periscope design in 1915, using a form shown in Fig. 4.

Kollmorgen and Jenkins disclose a similar application in patents granted in 1919, nos. 1,309,639 and 1,309,478, respectively; and an application to photographic lens design is found in a British patent 225,398 granted in 1924 to Robin Hill on a lens intended to cover a field of 180 degrees. Many will recognize it, for it was given considerable publicity at the time. In this combination, the distortion due to the negative lens is welcomed; it would be impossible, of course, to cover the 180-degree field without it. In motion picture lenses, on the other hand, whether applied to photography or to projection, the amount of permissible distortion does not much exceed 0.5 per cent.

Finally, it is not to be understood that this is the only way in which it is possible to design a lens of one-inch focal length with enough speed and covering power to be satisfactory for 35-mm. film. It is merely the most successful method yet tried.

NEW RADIO CITY THEATRES INCLUDE NO 'NOVEL' PROJECTION FEATURES

James J. Finn

BOTH the trade and public press have been unusually generous in the amount of space accorded the theatres (International Music Hall and RKO Roxy Theatre), included in the new Rockefeller Center (popularly known as Radio City), development now nearing completion in New York City's midtown section. This development as a whole is a most unusual achievement, but a personal tour of the entertainment auditoria fails to disclose anything startling in the way of projection equipment, room plan or effects.

Noting the large heads and numerous columns of type anent these theatres in the trade press (one exhibitor paper having given 26 columns of space to date, with a promise of more to come; while a projection paper rambled on interminably for a mere 9 columns), we decided to inspect these theatres. This inspection, as previously stated, disclosed nothing radically new.

A projection room some 55 feet long, 12½ feet wide and 10 feet high has many counterparts throughout the world, as far as space is concerned. The color scheme of the room itself is rather nice but also rather unimportant. Fused links for shutter openings are standard equipment in any good theatre. Optical glass for observation ports ditto. Four Super Simplex mechanisms and Hall & Connolly HC-10 lamps are no mystery to the well-informed projectionist. Effect machines and spots also are standard equipment.

Projection Room Ventilation

The new RCA "High Fidelity" sound reproducers have been described in detail in these pages. Pre-focus exciting lamps are commonplace by now and constitute a practice adhered to by all good projectionists. There has been considerable talk about the "unique" ventilation system in the new RKO Roxy Theatre projection room, with each lamp being vented to the outside air and with the projection room itself being hooked into the main theatre ventilating system. The same identical thing has been on view in the New York Paramount Theatre, where it probably was first done, since 1926, and here, too, each compartment in the special reel storage cabinet is vented to the outside air. Still, when Harry Rubin did all this pioneering in projection room construction and layout nobody went into raptures about it; yet today, in 1932, the very same thing is handed to us as being absolutely "unique." Rubin also probably was the first supervisor to provide full locker and showerbath facilities for projectionists in a space immediately adjoining the projection room.

That which is decidedly unique in Radio City is the Thyratron Color Control system, which utilizes Thyratron tube control for effect lighting. This development was described in detail in INTERNATIONAL PROJECTIONIST for August, 1932, p. 11. It is true that the projection angle in the new RKO Roxy is 24°, but in view of the great reluctance of architects and owners to attempt projection-on-the-level, this fact need occasion no great surprise.

The distance from the projectors to the rewind room in the new Roxy is about 30 feet, for which there appears to be no valid excuse.

There is no intent in this article to decry the good work done in the layout and equipping of this new RKO Roxy Theatre, but it does seem as though those who occupy the responsible position of disseminating information to thousands of men in the field should exhibit a more critical attitude before becoming all excited about "unique" features which upon examination prove to have been done some six or seven years ago. A more critical sense on the part of some of these publicists might prevent the acceptance of ideas and products which subsequently work out to the great disadvantage of the art.

Nothing New or Novel

Mere size and bulk should not suffice to cause presumably experienced projection workers to go into ecstasies about "unique" improvements which prove to be common practice. As an excuse for filling space, or as a "leader" on which to base a special issue or section and thus glean gobs of extra advertising, large projects like Radio City serve an admirable purpose—that is, for the publishers.

The RKO Roxy is a very good theatre job, like hundreds of other theatres built within the past five years. There is nothing new or novel, from a projection standpoint, connected with the project. The overall specifications for this theatre are interesting only to the extent to which they are indicative of the surprisingly sparse development work done in the projection field within the past few years. Probably the most important feature in connection with the opening of this new theatre is the fact that it provides an opportunity once more for a display of talent in things projection by Arthur Smith, the projection big-wig in Radio City, who for years has worked with "Roxy" and who has demonstrated his abilities to use good equipment and ample facilities to the best advantage of the projection art.

DOUBLE REEL SURVEY ON ACADEMY PROGRAM

Adoption of 1,800-foot film length as standard regarded as certain to result from Academy inquiry into theatre technical practices

THEATRE practices, bearing on both visual and sound reproduction, have been accorded a prominent place in the schedule of activities of the Research Council of the Academy of Motion Picture Arts & Sciences. A continuing interest in the theatre field, following closely the activity of the Academy in the matter of the Standard Release Print in the establishment of the Uniform Aperture, is reflected in the recently published program of the Council. An expanded program, concentrating upon economies in studio methods and improvement of the technical quality of pictures on theatre screens, is planned by the Council.

Preliminary reports have already been presented by eight sub-committees which have been investigating the following subjects: development of a silent camera; correction of distortion in theatre projection; establishment of a uniform practice for the length of film reels; study of more efficient use of the 35 mm. film area; improving the quality of release prints; study of waste-prevention methods used in sound recording by various studios; study of film preservatives now in use; and setting up a uniform practice on non-halation color tints for settings and costumes.

Double Film Reels

Of paramount interest and importance to the projectionist is the question of uniform reel lengths. Many attempts have been made to arrive at a sensible conclusion to this problem, but thus far the wide differences of opinion among producers, exchange men, circuit heads and projectionists have admitted of no solution. It is a foregone conclusion that the Academy, through its Research Council, will recommend the adoption, and make a strenuous fight for the acceptance and observance, of such a standard. The Academy is bound to encounter stiff opposition in its efforts in this direction by reason of the existence of legislation barring the use of the double, or 1,800-foot, reels in the theatre and also because of the obvious antagonism of many local unions toward such a standard.

It is regarded as certain that the first move on the part of the Academy to press for adoption of the double, or 2,000-foot, reels as a standard will be the signal for a concerted move on the part of projectionist local unions throughout this country and in Canada to block any advancement of the plan. Failing to win the support of the unions, the Academy is regarded as unlikely to meet with any great degree of success. Many local unions already are on record opposed to the double reel through the medium of legislation which carries a severe penalty in the form of a fine meted out to any member who doubles up reels.

Other Academy activities of interest to the projectionist are those relating to the study of a more efficient use of the 35 mm. film area, the study of film preservatives now in use, and the correction of distortion in theatre projection. The announced program of the Research Council of the Academy relative to the foregoing topics follows:

Establishment of an Effective Uniform Practice on Reel Length

Problem: In cutting, release printing, distribution, shipping and exchange inspection, the producing companies are using the reel of from 800 to 1,000 feet, which has been the established unit for many years. Most theatres, however, are equipped with 2,000-foot magazines and an increasing proportion are doubling up reels for projection. The situation is complicated by the preference for longer reels among many projectionists in first-run houses, by the number of theatres in which only one projectionist is employed, by the fact that studios are frequently unable to avoid issuing reels of very short length, and by the fact that exchanges have not been able to enforce penalties against reel doubling.

By far the largest number of reprints required are for beginnings and ends of reels, and the practice of doubling is responsible for much of the mutilation of the reel ends, as frames are lost every time the leaders are cut off and respliced. The Standard Release Print assumes that reels will be projected in the lengths in which they are distributed. Its efficiency for precision change-overs is lost when the reel ends are not maintained.

Proposed: To secure further data from all companies to determine the extent of the practice of reel doubling and the annual cost to the industry. To determine the most efficient length of reel unit, from the viewpoints of production, shipping, projection and cost. To particularly investigate the feasibility of release in lengths of 1,600 to 1,800 feet, using reels with 4-inch hubs to reduce wear on film ends. To carry on development of improved designs of shipping reels. To study disc release in relation to reel length. To propose a comprehensive program to give the industry the advantage of unified action in establishing an effective uniform practice.

Methods to Raise the Average Quality of Release Prints

Problem: Laboratories in Hollywood operated by or in close touch with the production studios have established high standards of quality and uniformity of product. In many cases release prints and replacements are made by laboratories located in all parts of the world and under present conditions no company can be sure that these will be as good as Hollywood prints obtained from the same negative. Measuring instruments of the various laboratories are not calibrated to any common standard and specifications for optimum prints are difficult to set and enforce.

Proposed: To continue the work of the present sub-committee in the local field in formulating and giving formal recognition to those desirable standards of processing and quality as to which there is general agreement. To bring more forcibly to the attention of production executives generally the desirability of insuring that the theatre release is of as good quality as the answer print. To employ one or more technicians for specialized research under the direction of a sub-committee. To undertake a program along the following lines: Standardization of review room projection equipment. Establishment of international standard reference sensitometer. Establishment of standard means for calibrating densitometers. Further investigation of the proposal to incorporate a density spot or simplified sensitometric strip in negative leader of each reel as means of specifying print requirements.

Investigation of Film Preservatives

Problem: A number of compounds are on the market which manufacturers claim will lengthen the life of release prints, protect the surface from scratches and reduce buckling and warping. Studios and laboratories have tried these preparations from time to time and found both advantages and disadvantages, but

EMERGENCY INTERRUPTION FIGURES

THE average theatre is open to the public 52.8 hours per week and the lost playing time per theatre, due to emergencies, is .088 minutes per week. These averages are the result of a survey made by the Operating Planning Division of Electrical Research Products in the course of weekly duties and covers almost 5,000 theatres or, approximately, 90 per cent of the theatres using Western Electric equipment.

Both the highest and the lowest averages of show hours occur within the Northeastern Division, varying from a high of 81.9 show hours per week among 129 theatres in Manhattan to a low of 40.6 hours in 122 theatres of the Scranton, Pa., district. The highest division average, 54.1, is also in the Northeastern Division while the lowest, 51.2, is in the Western Division embracing the Los Angeles, Portland, Salt Lake and San Francisco districts.

The compilation indicates that, in addition to show hours, the equipments are in operation 1.4 hours per week for previews and rehearsals.

no impartial and scientific comparative tests have ever been made.

Proposed: To test the claims for the principal preparations under practical conditions of use with high intensity projection lamps, etc., and make recommendations for the information of the studios on the basis of efficiency in relation to cost.

Study of More Efficient Use of the 35mm. Film Area

Problem: The addition of the sound track and the changes in image frame brought about by the requirements of sound pictures have resulted in considerable areas of the standard 35 mm. film not being used. The width of the sound track is now matted off in the camera from the negative. On both the negative and positive approximately 14 per cent. of the length of the film is now taken up by the frame lines.

Proposed: To undertake systematic preliminary investigation of the possibilities of either using the film area or salvaging it through adaptations of equipment. To determine what possibilities are feasible from technical and economical considerations and what saving might be secured in relation to the cost of making changes.

Study of Correction of Distortion in Projection

Problem: Vertical distortion of the screen image because of the angle of projection has been a serious problem for many years, made more acute by the construction of large theatres with very steep projection angles. Keystone distortion, loss of image area at sides due to keystone and the uneven focus from the tilted focal plane are associated problems. Research toward the development of some prism or other optical device to correct these distortions has never been carried far enough to thoroughly test possibilities of such correction.

Proposed: To secure whatever data is at present available in the field. To define the objectives and indicate the principal practical problems. To sponsor further study on the problem.

MECHANICS OF BINOCULAR VISION

David Levinson

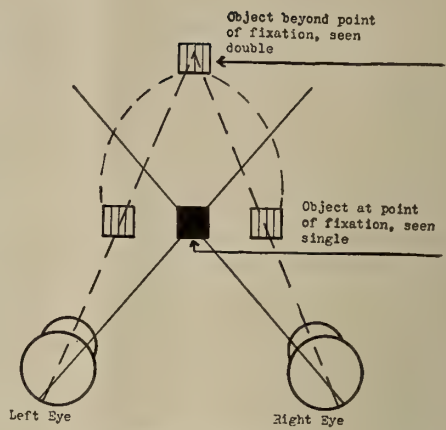
BINOCULAR vision, or singleness of vision with both eyes in use at the same time, exists when rays of light from any one point strike the same portion of the retina (the inner, most sensitive coat of the eyeball), of each eye and produce a similar image on corresponding portions of the retinae.

The important advantages of binocular vision, *the presence of which is obviously absolutely essential for the proper conception of motion pictures,* are the appreciation of solidity and the accurate determination of distance.

For binocular vision to be pleasant and acceptable, the eyes must have equal sharpness of vision, and both must be directed to the same object. In such instances, there is then an image formed on corresponding points of the retinae, and as they are exact reproductions one of the other, they are fused by the brain to give the impression of a single object.

Only one point can be found in the line of direct vision for both eyes at the same time. An object properly located in the line of direct vision is distinctly seen by both eyes in the center of the field of vision. Thus its two visual images exactly cover each other and appear single, though seen by both eyes. Double vision at once results when the image of an object is formed on parts of the retina which do not exactly correspond in the two eyes. When this condition prevails, the two images are so different that the brain is unable to blend them into one.

In the accompanying sketch, the eyes are so directed that the nearer object occupies the point of fixation and is seen clearly and singly. The farther object will also be seen, but it will be seen indistinctly, principally because it is not in the line of direct vision. For the right eye, the farther object will be observed



Illustrating binocular vision

to the right of the line; and for the left eye it will be seen to the left of the line of direct vision. In other words, its two images do not correspond in situation, and the object appears double.

AVERTING OLD AGE

OLD age is a condition of the blood due to slow self-poisoning of the body. Insufficient supplies of food materials, mineral salts and stimulating gland chemicals are supplied by an aged and sluggish blood system to the organs of the body. So old age was described by Dr. Arnold Lorand, of Carlsbad, Germany, before a recent meeting in London.

By correcting this blood condition, supplying more blood to the tissues and providing this blood with ample quantities of the necessary food elements, including the gland chemicals and salts, it almost always is possible, Dr. Lorand asserted, to prevent premature old age and to make the average man of 65 look and feel 55 or even younger. The chief practical way to do this, the German expert believes, is by means of diet. The numerous varieties of gland operations supposed to produce rejuvenation he rejects as not likely to be effective.

For the sake of long life and vigorous health in old age, he told the London medical organization, the best diet consists of milk and milk products like butter and cheese, brown bread, fresh vegetables and fresh fruit. To this may be added a few eggs and fish but only a small amount of meat. Fat meat is especially bad for long life, he believes, since it often fails to digest promptly and thus causes poisonous substances to be set free into the blood. The best kinds of fatty food for a long-life diet, he believes, are the easily-melted fats, like butter and olive oil.

IT is difficult in these trying times to direct the thought of projectionists to quality work, particularly when their employers are so unresponsive to anything but quantity. It should be remembered by every projectionist, however, that the only thing he has now, or ever had, to sell is better work. Once this fact is lost sight of, projection becomes not a specialized job but a wide-open field for every manner of man. *Remember this.*

RECENT ADVANCES IN THREE—DIMENSIONAL PICTURES

Hugo Lateltin

MEMBER, LOCAL UNION 306, I. A., NEW YORK CITY

THE practical realization of three-dimensional motion pictures apparently still is beyond the reach of serious workers in the art. Many attempts to attain this goal have resulted in numerous "systems" the failure of which was foreordained because of their being either impractical or prohibited by excessive costs. Even a casual review of scores of patents already granted covering stereoscopic motion pictures induces amazement relative to the ludicrous conceptions underlying a majority of them.

Whenever man sets out to re-create by artificial means those conditions which are necessary for the natural stimulation of our organs of sense, his success, or lack of it, may be measured in terms of the effort expended to truthfully reproduce the sequence of events leading up to the normal functioning of a particular sensory experience.

The diaphragm of a telephone receiver enables us to hear speech because its sets up sound waves similar to those set up by the human voice. The moving picture copies accurately the natural development of motion, which is a succession of innumerable positions of a moving object. The film partially reproduces these positions and thereby creates artificially the sensation of an object in motion. The work done to date in the stereoscopic motion picture field would seem to lend strength to the opinion that the solution of the problem lies in ignoring all "trick" processes and concentrating on the work of faithfully copying the natural conditions inherent in three-dimensional vision.

What is the outstanding problem the solution of which will lead to a satisfactory stereoscopic motion picture? On the basis of the work done to date, it is obvious that a successful stereoscopic process will have to satisfy the requirements of *binocular vision*. As far as careful checking can determine, there is available today no satisfactory means for the production and reproduction of stereoscopic pictures, but the results of a recent series of tests hold out some hope for attainment of this result. But first let us consider binocular vision.

To achieve a satisfactory representation of depth it is necessary to meet the requirements for binocular vision. First, separate pictures representing the right eye and left eye views have to be taken, and second, each eye must see only its appropriate picture. Outstanding workers in the art are agreed that there can be no departure from these requisite fundamentals, if success is to be attained. Several methods have been employed to obtain this result.

Existing Processes

The *anaglyph method* utilizes red and green filters positioned directly in front of the observer's eyes. The left eye and the right eye views on the film are alternately colored in red and in green. The observer's eye before which is placed a green filter will see those pictures which are colored in the complimentary color —that is, red. This arrangement insures that the eye will receive only its appropriate view. In the *stereoscope method* two images are projected side by side upon a screen, and these are viewed by an ordinary stereoscope. The *polarized light* method polarizes the light of the left eye in one plane and the light of the right eye view in a plane turned 90° toward the former. When observed through a polarizer in front of both eyes, each eye will see the view indigenous to its position. The *eclipse method* projects alternately left and right views and uses a revolving shutter near the eyes which runs in synchronism with the film, cutting off the right eye view from the left eye and *vice versa*.

None of the foregoing methods has been found practical for general application in the theater field. The handicap common to all these methods is the necessity for providing each observer with a suitable analyzing device. The goal of all serious work in the stereoscopic motion picture field is the elimination of a separate analyzer for each observer. Recent research work looking to this end offers great hope for the not too distant future, and, in fact, still pictures which reflect a thorough understanding of the fundamental requirements for stereoscopic motion pictures are now available.

H. E. Ives of Bell Telephone Laboratories has given a concise and extremely clear exposition of the problems involved in the production of three-dimensional motion pictures.[1] While expressing grave doubt as to any great immediate advance in art, the Ives presentation is crystal clear in its enumeration of the factors involved in working out the problem of three-dimensional motion pictures. One who wishes to obtain a comprehensive understanding of the status of this art should not fail to read this paper.

Dr. Kanolt's Fine Work

Of considerable interest to workers in this field is the fine work done by Dr. Kanolt, of the Perser Corporation,[2] who has devoted many years exclusively to the achievement of stereoscopic still and motion pictures. Dr. Kanolt holds numerous patents relating to the art and only recently has been granted a patent[3] on the application of his stereoscopic still pictures to motion pictures. His still pictures already are in wide use for commercial and scientific purposes. The Kanolt method might be designated "Parallax Panoramagram," the term used in the Ives paper previously mentioned. The efforts of Dr. Kanolt deserve particular attention, inasmuch as his work with still pictures proves beyond a doubt the sound basis upon which he has builded and placed his hopes for success with stereoscopic motion pictures.

Before proceeding to the motion pic-

"Hogging" Features Forces Theatre Closings

THE limited number of feature pictures available for booking by independent theatres has given rise to a new abuse on the part of theatres having circuit connections, according to reports from various sections. This "hogging" of available features, many of which, it is reported, never reach the screen but are merely shelved, results in enforced closing of independent theatres, with consequent unemployment.

INTERNATIONAL PROJECTIONIST will gladly clear any specific complaints anent this practice submitted by Local Unions.

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1 "The Problem of Projection Motion Pictures in Relief," by H. E. Ives. Journal of the S.M.P.E, April, 1932, Vol. XVIII, No. 4, p. 417.

2 New York City.

3 U. S. Patent 1,882,648.

ture application of "Parallax Panoramagram," let us consider the method used in making still pictures. Figure 1 illustrates the arrangement in the studio for taking stationary photographs. A camera, mounted on a carriage, is moved in a semi-circle around the object to be photographed. The angle described may be as much as 60°. The purpose of moving the camera around the object is to obtain a plurality of different views. As is shown in Figure 1, in the upward or right position of the camera, a ray of light proceeding from the center of the object is projected by the camera lens to the center of the photographic plate. In front of this plate is a lined screen consisting of a great number of narrow vertical strips. The open slits between these strips will pass the light to the surface of the plate.

'Shooting' the Picture

In the upward position of the camera shown in Figure 1, the center ray meets the light sensitive plate at *a*. While the camera is in motion the photographic plate is slightly displaced horizontally to one side. This displacement equals the distance from one slit to the neighboring slit and is accomplished by means of an electric motor which turns a micromatic screw. When the camera has reached the left position, the point *a* on the plate is now covered by a strip of the lined screen and therefore is no longer exposed to light impressions. A center ray from the object will now meet the photographic plate at *b*.

Position *a* on the plate would represent a right eye view, and position *b* a left eye view. Between these two positions there are a great number of separate exposures, all caused by the motion of the camera around the object.

Figure 2 illustrates the actual viewing of a stereoscopic still picture produced by this method. The photographic positive is illuminated from the rear. In front of the positive is placed a lined screen, similar to the one used in the camera. Figure 2 shows how rays from *b* on the plate enter the left eye, and how those from *a* the right eye, thus making visible to each eye its appropriate view. The extreme narrowness of the slits makes it impossible for the right eye to see the left eye view, and *vice versa*.

Motion Picture Application

The application of this method of producing still pictures to motion pictures is impracticable, if not actually impossible, for a very definite reason, and this is that the time required for the exposure of one complete picture ranges from 10 to 60 seconds. Present-day motion pictures are run at a speed of 90 feet per minute, with each separate picture being allotted an exposure time of one twenty-fourth of a second. This means, then, the elimination of the motion of the camera around the object.

Figure 3 represents one possible arrangement for the taking of stereoscopic motion pictures. An elliptical mirror concentrates the light received from different angles upon a ribbed mirror mounted in front of the camera. The elliptical mirror, which may be constructed of one piece or of a series of individual mirrors, makes unnecessary the motion of the camera around the object. The ribbed mirror, which takes the place of the lined screen used in the still picture process, has a surface with a great many fine ribs. This mirror has the advantage over the lined screen in that it is not as wasteful of light as is the latter.

Each rib receives all the different views obtainable by the elliptical mirror of a certain part of the scene to be photographed. Each rib in turn will throw a narrow band of rays onto the moving film, each band corresponding to the multiple exposures produced between *positions a* and *b* as shown in Figures 1 and 2. If a film photographed by this method is projected onto the rear surface of a screen and viewed through a lined screen from the front, it will necessarily give depth to the picture.

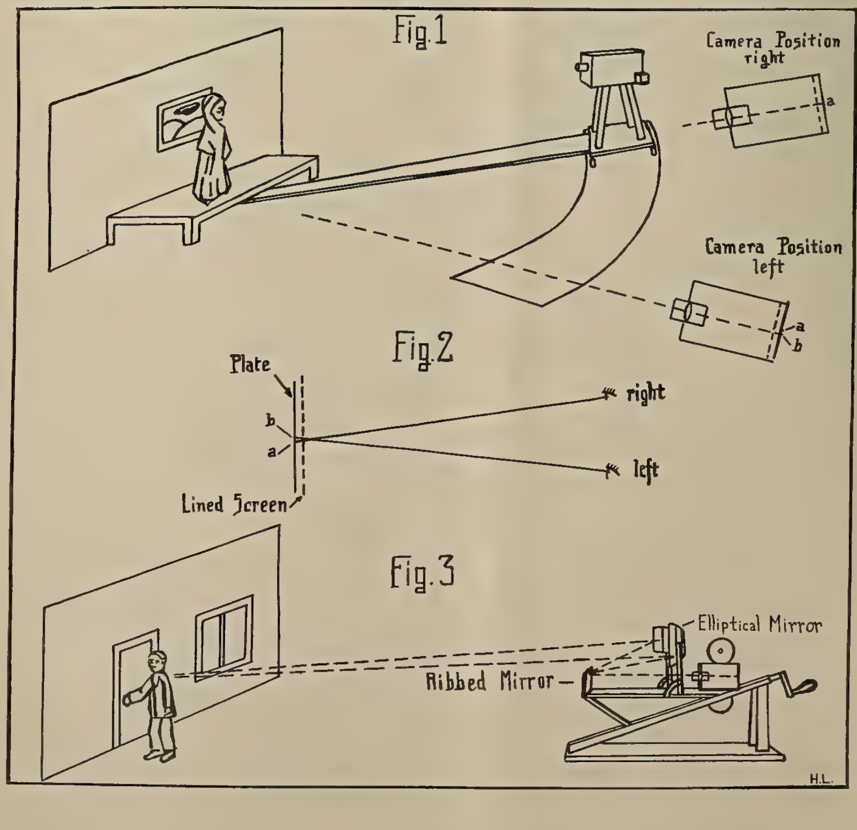
No Projector Change

The projector itself would remain the same in construction as it is today, and only the screen would have to be changed. Instead of rear projection, which is seldom used at present, front projection could be employed with the aid of a specially constructed ribbed screen, enabling each observer in the audience to receive with each eye the view intended solely for each eye.

Other Possible Methods

A number of other possible combinations in the production of stereoscopic motion pictures come to mind, but it seems certain that all of them will employ either an elliptically shaped mirror or a large lens, or lenses, to gather the varied views of the object. Prevailing economic conditions have seriously retarded the practical fulfillment of three-dimensional motion pictures, and it is not unlikely that there still remain ahead a number of years of intensive development work before a wholly satisfactory process will be at hand. It seems certain, however, that past and present tests have established certain fundamental laws as a guide for future correct procedure.

The introduction of three-dimensional pictures will affect the projectionist only to the extent that greater care and experience will be required. Undoubtedly the arrival of the stereoscopic motion picture will tend to improve the conditions under which the projectionist works, in line with the proven theory that greater requirements tend to make the field more exclusive and open only to the trained man who, while able to progress and keep pace with new developments in his craft, possesses a good background gained through years of experience.



Receivers For 306; Kaplan Fights I. A.; Alliance Control Praised

Kaplan Termed "Public Enemy No. 1" to All Union Labor

Trial Set for January 16

APPOINTMENT of receivers for Local Union 306 of the Alliance by Supreme Court Justice Salvatore Cotillo in New York City on December 27 brought to a temporary close a surprising series of events which followed in the wake of the removal from office of Sam Kaplan, president, and 20 associated officers by a unanimous vote of the General Executive Board of the Alliance. The receivers named were John W. Davis, former President of the American Bar Association and Democratic presidential candidate in 1924; Hugh Frayne, officer in the New York State Federation of Labor, and J. P. Dunn, well-known New York attorney.

Justice Cotillo's action in appointing receivers for the Union, described by the Justice himself as an "extraordinary remedy" designed to end a condition of "chaos" existing in the affairs of the Union, met with disapproval on all sides and in particular by labor leaders throughout America, a majority of whom assailed the decision as unprecedented in the history of the American labor movement and constituting a misuse of judicial power. Outstanding in the wave of criticism which rolled in upon President William C. Elliott of the Alliance was a wire from President William Green of the A.F. of L., a copy of which accompanies this article.

Decision Modified

On the day following announcement of the receivership the case was reopened by Justice Cotillo to permit of a judicial interpretation of the decision, announcement of which obviously created greater confusion among interested parties, including the membership, than that which the decision was announced as seeking to end. The interpretation placed on the decision by the Justice himself was that the three receivers were to act merely in a supervisory capacity as overseers of the funds of the Union, in addition to acting as a board of review on suspensions and expulsions, if any. The effect of this interpretation is to continue the direction by the International Alliance of the Union's affairs, with Harland Halmden, seventh vice-president, slated to remain indefinitely as immediate overseer.

It is expected that the General Office of the Alliance, while naturally pleased with the liberal interpretation of the receivership by the Court itself, will move at once to appeal the decision to the Appellate Division.

Preceding the appointment of receivers by Justice Cotillo, and extending beyond the events chronicled in the last issue of INTERNATIONAL PROJECTIONIST, were certain developments, a chronological exposition of which is necessary in order to properly convey a clear picture of the present situation.

It will be recalled that the order of the Alliance removing the Kaplan crowd was served on Kaplan in a Bronx courtroom in which was being tried a suit by three members of Local 306 (Doragoff, Giesemann and Simon), to oust Kaplan as president and to effect the appointment of a receiver for the Union. This trial, as recounted last month, had been productive of sensational testimony relating to the allegedly high-handed control practiced by Kaplan and also relative to the alleged "inside" relations existing between Kaplan, in his dual capacity as leader of 306 and head of a projector and parts manufacturing company, and certain exhibitors in New York. One exhibitor, John Springer, head of the Springer-Cocalis circuit of 35 theatres, took the stand to testify that for years his circuit, although non-union, bought parts from the Kaplan company and was not molested. The moment the circuit shifted its buying elsewhere, Springer further testified, Kaplan immediately instituted an intensive strike campaign to unionize the circuit.

It was into this tense atmosphere that legal representatives of the Alliance injected their surprise announcement of Kaplan's removal.

A. F. of L. Supports Alliance Head

COSHOCTON, OHIO
DECEMBER 28, 1932

WILLIAM C. ELLIOTT
PRES., I.A.T.S.E. & M.P.M.O.U.
1450 BROADWAY, NEW YORK.

I REGARD THE APPOINTMENT OF RECEIVERS FOR LOCAL THREE HUNDRED SIX AS AN UNJUSTIFIABLE INVASION OF THE LEGAL AND ADMINISTRATIVE RIGHTS OF YOUR INTERNATIONAL UNION. THE LAWS OF YOUR INTERNATIONAL UNION PROVIDE MEANS AND METHODS BY WHICH LOCAL COMPLAINTS AND GRIEVANCES MAY BE DEALT WITH AND ADJUSTED. THESE LAWS SHOULD BE RESPECTED AND SHOULD NEITHER BE SUSPENDED NOR SET ASIDE EVEN BY A COURT. YOU AND YOUR ASSOCIATE OFFICERS DULY ELECTED AND CLOTHED WITH OFFICIAL RESPONSIBILITY SHOULD BE ACCORDED FULL OPPORTUNITY AND AN EXERCISE OF THE RIGHT TO SETTLE JUSTIFIABLE GRIEVANCES WITHOUT JUDICIAL INTERFERENCE. I HAVE FULL CONFIDENCE IN YOU AND YOUR ASSOCIATE OFFICERS FOR I KNOW YOU WILL DO THAT WHICH IS JUST AND RIGHT IN THE DISCHARGE OF ALL OF YOUR OFFICIAL DUTIES.

WILLIAM GREEN
PRESIDENT, AMERICAN
FEDERATION OF LABOR

Receivers to Act Only in Supervisory Capacity

Alliance Retains Control

Kaplan Fights the I. A.

Kaplan's intentions to seek the aid of the courts in resisting the I.A.'s authority to oust him, as reported herein last month, developed into an actual fact a few days after he was removed. Of special interest herein is the fact that Kaplan lost no time in rushing into court in defense of his "rights," a practice which he, as head of 306, had for years denounced vigorously and which under his regime usually was followed by suspension or expulsion. The removal order of the I.A., incidentally, carried a proviso that neither Kaplan or any of his officers could stand for office within five years.

Kaplan's action against the Alliance came up in Supreme Court on December 9, with the Kaplan attorneys basing their arguments on the contention that the Alliance had not formally preferred charges against Kaplan, had not given him an opportunity to be heard in his own

defense and had acted unconstitutionally. This was the second exposition of the Kaplan viewpoint, as earlier the same week a temporary injunction had been denied him.

The reply of Alliance attorneys was devastating to the Kaplan appeal. It embraced the statements that the General Executive Board, being empowered to suspend the national constitution in the event of a "national emergency," had considered the Kaplan charges as approaching that degree of gravity and had acted accordingly. In addition, pursued counsel for the Alliance, Kaplan was "Public enemy No. 1 of all union labor."

'Vast Sums Unaccounted For'

Alliance lawyers then proceeded to sketch the Kaplan career as leader of Local 306, their argument revealing for the first time the extent of the charges against him. These included oppression of the opposition, the inciting of physical assaults, discrimination among union members, "general terroristic activities," employment of non-union labor in a private business enterprise, wage-scale favors to firms which dealt with his private enterprise, the bringing of the Local into general disrepute, the using of Union power for personal benefit, and, in conclusion—for the first official pronouncement by the I.A. on the topic—"*mismanagement and illegality in handling funds amounting to* $800,000 *without proper accounting and with vast sums unaccounted for.*"

After hearing arguments, Justice Cotillo reserved decision.

Pending announcement of the decision in this case, President Elliott of the Alliance issued a statement to New York newspapers which said in part:

"The kind of rule that has been exercised over Local 306 is gone forever. I am proud to say I had the support of the Central Trades and Labor Council of New York, with its hundreds of thousands of members, and the whole-hearted co-operation of the American Federation of Labor. Now I solicit the support of public opinion."

Meanwhile the Alliance continued its control over Local 306, with Harland Holmden, seventh vice-president and business manager of Cleveland Local 160, with the help of only a staff of girls and one man, continuing to turn out daily work which formerly required the "services" of a staff of 20 men, in addition to the girls. Holmden's direction of the Union is winning high praise from all fair-minded members and exhibitors in New York, a feeling which eventually prompted the circulation of a petition asking that he be kept on the job permanently. Many members of Local 306 frankly declared that they never suspected that any union could be run in the eminently fair manner exhibited by Holmden, whose stewardship, they said, in itself was sufficient to render impossible a return to power of any group seeking to dominate the Local for selfish ends.

The next development was the application of Nathaniel Doragoff, one of the plaintiffs in the original receivership trial which was interrupted by Kaplan's removal, for an injunction restraining the I.A. from revoking the charter of Local 306. Doragoff's appeal was based on a "potential" judgment for loss of pay incurred, he claimed, under the Kaplan regime, and forthcoming to him "when and if" the interrupted trial was resumed. This application was denied by Supreme Court Justice Hammer.

A decision on the Kaplan application for a permanent injunction restraining the I.A. from ousting him and also preventing it from assuming control of Local 306 was handed down by Justice Cotillo on December 20. The Justice imposed two conditions in denying the injunction: (1) that the action be set down for early trial (January 16, 1933), and (2) that the Alliance permit an early election of temporary officers to serve meanwhile and to continue in office in the event final determination was adverse to Kaplan. The decision said, in part:

"Since Kaplan is out of office, at least for the time being, by lawful process, he cannot compel reinstatement at the present moment.

"The accusations and their public airing brought about a situation of scandal with serious effects upon organized labor. They become so widespread that the president of the American Federation of Labor and of the executive council took official as well as unofficial notice thereof. It was generally recognized that the situation with respect to Local 306 was detrimental not only to those immediately connected with the union but to organize labor as well.

"If Local 306 had requested it, I should have been pleased to appoint a high representative of the American Federation of Labor as an impartial stakeholder to act as receiver of the funds of the local pending determination of the action. But in view of the imminence of the trial, I do not regard this as necessary."

One week later, after numerous conferences and futile attempts to effect what was described as a "compromise" in the matter of election of officers for the Union, Justice Cotillo issued his now famous order appointing receivers for Local 306. Explaining his action, the Justice said that a "serious dilemma" arose when neither Kaplan, seeking reinstatement by court order, nor the International officials would agree to select each a representative to act with a third neutral party in running the Union. Mention was made of the fact that the International, which at first decided to hold an immediate election to select Kaplan's successor, later changed its mind and decided to maintain control. No mention was made of the fact that the International's plans for just such a move were caused to be canceled by Kaplan's move in the courts. As a matter of fact, on the very day of a scheduled nominating meeting, the I.A. was forced to wire every Local 306 member regarding the cancellation.

The Court's orders to the receivers, who will serve under a joint bond of $100,000, direct them to familiarize themselves with the Union's laws, better to discharge their duties, and "in so far as it can consistently be done" to preserve the allegiance of the Local to the International body. In cases of doubt, the receivers are to apply freely to the Court for instruction. Agreeing that an immediate election would be unwise, the decision holds that the "very large property and working rights of the members" require that the union not be continued under the "dictatorship" of the parent body (the International).

Decision's Poor Reception

As previously stated, the decision is unprecedented, a fact which labor leaders did not hesitate to point out. In the case of the Doragoff application for an injunction restraining the Alliance from lifting the charter of Local 306, Justice Hammer was quick to observe that the mere fact that an International has the power to grant a charter in itself lent strong support to the accepted view that it has equal rights in the matter of revocation of a charter. No judicial officer, prior to Justice Cotillo, has ever questioned the right of an International to step in and assume control of a Local Union chartered by it.

As for the alleged "chaos" existing in Local 306 under International control, many members of 306 were quick to point out that the Local had never had better direction and more able control than it had at the hands of the International. The lack of duly elected officers, these members said, was not sufficient indication of a condition of "chaos" to justify the appointment of receivers. The claims made by the opposing forces that the International has bungled in handling the affairs of Local 306 were hotly denied by members, many of whom characterized the decision as reflecting too much newspaper "color" relative to "fabulous sums" and "chaotic" conditions.

One of the most interesting, although not entirely unexpected, results of the removal of Kaplan was the sudden sprouting of hundreds of "politicans" who suddenly developed a desire to hold office in

(*Continued on page* 24)

Money Matters in Local 306

THE charge that "vast sums were unaccounted for," made by Alliance attorneys in their arguments opposing Sam Kaplan's plea for reinstatement as president of Local 306, was the first public acknowledgment by the I.A. that there is anything wrong with the finances of the Union. Many times within the past few years the so-called opposition faction in Local 306 has charged misuse of general funds but in no case was proof forthcoming. The I.A., through its legal representatives, finally has brought the matter out into the open by specifically charging "mismanagement and illegality in the handling of $800,000" of the Union's funds.

Another interesting aspect of the Kaplan case is the report that costs of operating Local 306 for 21 months approximated $1,500,000.

A MESSAGE

From the World's Oldest and Largest Manufacturers of Motion Picture Projectors

For nearly twenty years I have been actively connected with this Company and many others have been with us from ten years to over a quarter of a century. The manufacture of motion picture projectors is on a comparatively restricted basis calling for highly specialized knowledge and it is gratifying and important to have a personnel which is thoroughly experienced.

It is unfortunate that the industry does not more fully realize that in the manufacture of motion picture projectors precision workmanship has been established in our plant for many years which is only equalled in the manufacture of scientific instruments. Our personnel has a full understanding of the exacting requirements of the motion picture industry and we shall continue to produce and develop on the highest possible plane with reasonable, practical limitations, regardless of conditions.

The neglect of motion picture equipment is a false economy and the industry is paying far more through loss of entertainment value, damage to film and other evils, than would be incurred by reasonable repair and replacement. There is good reason to believe, however, that conditions are improving and that during the coming year theatre owners and managers will have a restored confidence which will enable them to see more clearly the harm done by unwise neglect.

With a firm belief that the outlook is already more cheerful and that much better times are not far away, I take great pleasure in extending to the Motion Picture Industry Best Wishes for A Happy and Prosperous New Year.

Samuel R Burns

PRESIDENT

INTERNATIONAL PROJECTOR CORPORATION, NEW YORK

NEWS and VIEWS

A collection of random thoughts, and some not so random; fact, fancy and opinion pertaining to the projectionist and projection matters. The free-for-all forum.

In Which We Answer A Few Questions

SUBSEQUENT to publication in I.P. for November of a picture of the ruins of the Lemay Theatre in St. Louis (Mo.), County, we received the following note from the eagle-eyed M. D. O'Brien of Loew's Theatres:

That picture on page 8 of your last issue, the ruins of the Lemay Theatre in St. Louis County, the caption accompanying which states that the damage was caused by a projection room fire due, apparently, to one-man operation, was a very pretty picture, as photographs go. It occurs to me, however, that a fire which could ultimately cause so very much damage must have been productive of intense heat, and said heat, in turn, undoubtedly would have blown the projection room wall, at least, right out into the street. Yet, I notice in the picture that the projection room is intact, the ports being clearly visible. Will you kindly tell the boys whether this picture is strictly on-the-level or whether you are anticipating April 1?

Mr. O'Brien was not alone in asking this question, and many other readers couldn't understand this apparent anomaly. Neither could we, for that matter, so we promptly put the matter up to Mr. O. Kleintopf, Business Manager of L.U. 143, St. Louis, the man who led us into this thing in the first place. Back came Mr. Kleintopf's answer:

It seems a damned shame, Mr. Editor, that we can't have a perfectly good fire resulting from one-man operation of a projection room without having to be subjected to sniping by some of your sharp-eyed readers. The Lemay Theatre which you inquire about was placed on the unfair list sometime ago. The manager then assigned his brother, who had no previous experience, to the projection room. This young man stated that when the film became ignited in the projector, he *just ran out of the room.* It seems queer, I know, but the fact is that this fire caused all that damage which was evident in the published picture, the fire evidently having worked forward through the theatre without blowing out the projection room walls. A newspaper clipping, which I enclose, reports the following:

". . . The fire started in the projection room, of fireprof construction, and spread to the storeroom when the street door was left open. The combustible material there—the stairs, falls and roof being of wood covered with tar paper—burned rapidly. . . . At 8.15 the fire was under control at the front of the building, when from the stage end, or rear, large billows of flame raced along the ceiling, floor and through the roof. This flame created such an intense heat that the girders supporting the roof buckled and fell. The roofing lasted but a few minutes. . . ."

When we passed along this information to the expectant Mr. O'Brien, all he had to say was: "Well, this is just one more example of what funny things can result from a projection room fire. A thousand such fires would probably progress in as many different ways, and it merely goes to prove that nobody can forecast the progress of such a fire. Particularly does this incident demolish the arguments of those who can chart on paper the exact amount of precaution necessary in a projection room or list those things which will absolutely 'prevent' projection room fires."

Projectionist's Responsibility In Effecting Repairs

WHERE does the projectionist's responsibility for the upkeep of equipment end? What work should a projectionist do on his own responsibility and what work should he send out? These and other questions bearing on the same point have long prompted spirited discussion among projectionists. In a certain locality, for obviously purely selfish reasons, local union legislation prohibiting projectionists from effecting even minor repairs was passed, the basis for this action apparently being the notion that if no work was done in the projection room, the manufacturer of projectors and parts would enjoy increased business. Such legislation is worse than silly; it is positively pernicious.

Other objectors to projectionists effecting repairs on the spot, among whom is F. H. Richardson, advance the argument that a projectionist can hardly be expected to thoroughly understand all the intricacies of a projector and that his "meddling" will result in great damage to certain delicate parts. This argument, while logical, does not cover enough territory, and it also runs directly counter to our notion that nothing should be done which will restrict the influence and prestige of a projectionist. That work which a projectionist reasonably may be expected to do was set forth in "Repair Work by Projectionists" in I.P. for August, 1932, p. 17.

We agree with F. H. Richardson that projectionists should be careful not to assume work for which they are not qualified, but we should not like to have projectionists interpret this warning to mean that they should do nothing in the way of maintenance. The fear that projectionists may damage delicate parts of a projector mechanism is greatly offset, we think, by the general knowledge that 999 projectionists out of every 1,000 are sure to avoid doing any work which they consider to be beyond their capabilities. This tendency may be charitably describe as being instinctive. It appears that a sensible outlook on this question would be that the projectionist should not hesitate to do anything he can to keep the show going. It is this for which he is paid, it is this ability to keep the show going which adds to a projectionist's prestige. Our personal opinion is that if projectionists knew more about the projector mechanism and used this knowledge to make themselves indispensable in a theatre, there would be less trouble all around.

The P. A. C. Asks Leave to Say a Few Words

BEARING on the publication last month of the Report of the Health & Safety Committee of the Projection Advisory Council is the appended letter

RECEIVERS FOR 306; KAPLAN FIGHTS I. A.

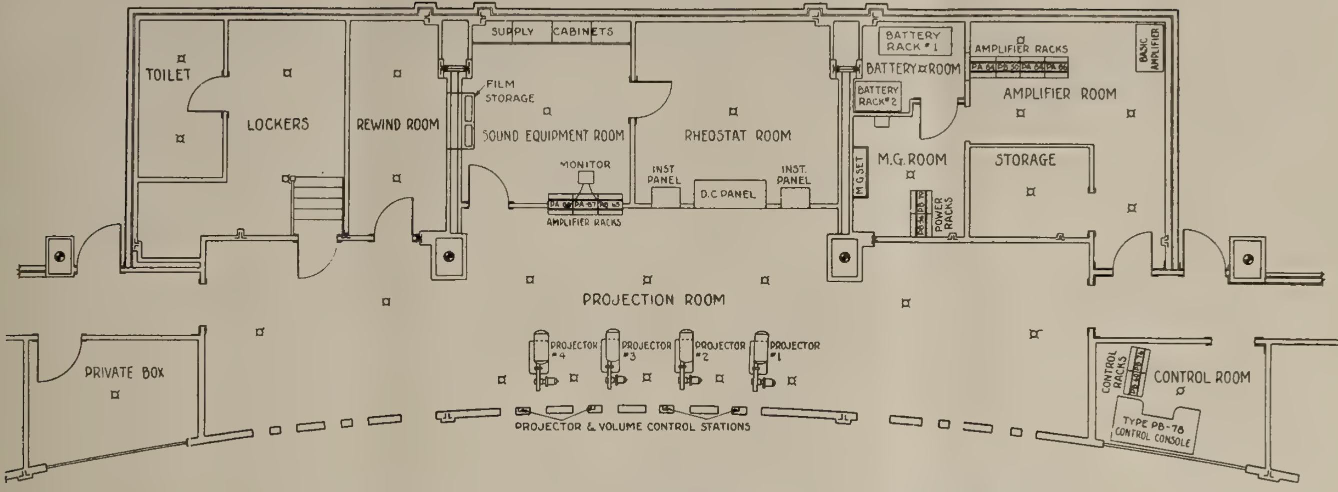
(*Continued from page* 22)

the Union, and the consummate ease with which several members of the so-called "Kaplan opposition" switched their lines of battle, forgot their altruistic motives and set out to reap personal gain.

Among close observers of the present situation in New York City there exists unanimity of opinion to the effect that powerful forces are at work seeking to block the efforts of the Alliance at every turn. Many exhibitors, obviously acting under pressure, suddenly succumbed to the urge to ask for reductions; petty cases requiring the attention of the General Office developed in great profusion; endless delegations called at the General Office to present their petitions for this, that or the other thing; the morning following the announcement of the appointment of receivers by Justice Cotillo, six officers of the group removed by the I.A. appeared at their old posts in Local headquarters and blandly announced that they were resuming their positions "upon the advice of counsel"; a girl clerical worker, discharged the day before, also appeared "ready for work"; and many apparently inexplicable developments occurred both within and without the Union.

Big stakes hang in the balance, and there is no lack of aspirants for the vantage place which will provide easy access into the pile.

Of the attitude of Locals outside New York toward the International there is absolutely no doubt. It is no exaggeration to state that without a single exception all I.A. units are behind the General Office in its present fight to restore New York to good standing. Indicative of this feeling was the action of the recent New England District Convention in voting *unanimously* to commend the I.A. for its action relative to Local 306. The General Office has expressed its appreciation of this support and has stressed the fact that its efforts in New York really constitute a battle for the entire Alliance, the prestige of which was seriously damaged by the course of affairs in the metropolis.



PROJECTION ROOM LAYOUT IN RADIO CITY THEATRE

from Mr. P. A. McGuire, executive vice-president. Incidentally, this report occasioned more interest among projectionists in the field than did any other single article we have published, probably by way of substantiating the truth of the assertion that projectionists easily work up a lather relative to those things which directly affect their work, their wages and their safety. The letter, in part, follows:

Dear Mr. Finn: . . . As you are well aware, the Council has been carrying on for over a year without asking for additional financial assistance from its members, but this has greatly hampered us in our work. We have fully taken into consideration the disturbed conditions . . . and have tried very hard to render certain services to projectionists . . . without burdening them with additional expense. You have rendered the Council a great service through publication of the reports of Messrs. Yager and O'Brien. These reports represent far more work than will be readily understood, and it would have been most regrettable if they had not been brought to the attention of projectionists . . . through publication in your periodical.

Mr. Yager, Mr. O'Brien, yourself and this organization have worked hard to gather and to distribute information for which there obviously existed an urgent need, and the officers of the Council sincerely trust that all projectionists units will use these facts and send us additional details so that we can properly carry on these highly important activities.

It is true, of course, that if this matter had not been published in I.P. it could not have been brought to the attention of projectionists. This is just another indication of the lack of coordination in projectionists ranks. Mr. McGuire is very reasonable in his demands, we think, inasmuch as he might very well have attempted to trade on the tremendous interest which these reports evoked by asking for contributions. That he did not do so is *prima facie* evidence of the sincerity with which this work is being accomplished.

Incidentally, it has been suggested that every local union in the Alliance buy at least three copies of this report (at 25c apiece, or a total of 75c), which sum would just about pay the expenses incident to reprinting in convenient pamphlet form.

HUMAN EYE SEES LIKE TELEVISION CAMERA

"SCANNING," a common term in television, believed by many people to be something new, is really as old as man, states Hollis Baird, chief engineer of the Shortwave and Television Corporation. "The human eye," he says, "has always scanned and always will." When we look at a picture or a scene, we do not see it all at once; we see only a tiny spot. Our flexible, efficient eyes rapidly travel across and up and down a given scene, registering the various points so rapidly that a complete picture seems to be seen. Says Mr. Baird:

"It is easy enough to test this. Hold your hand out straight in front of you and then look at the thumb-nail. Now without shifting your eye in the slightest try to see how much else you can see clearly, not just suggested, but vividly. You will find that the area comprising the end of your thumb is about all that is sharp.

A Piecemeal Picture

"Now open your hand and decide you want to see all of it. As you do, notice carefully what your eyes are doing and you will see that they are swinging back and forth in various cross directions until they have covered every bit of your hand. Now you have a very definite picture of what your hand looks like, yet it was obtained piecemeal.

"Taking something more concrete, more nearly like what the television camera must pick up, let us look at a motion-picture. As the action goes on, you seem to see what is happening on the whole screen, but if you will pick out a single spot on the screen and look at it without moving your eyes, as you did when looking at your thumb-nail, you will find you are actually seeing but a

THE I.A. AND THE NEW YORK SITUATION

(*Continued from page 6*)

proper conduct of which is of the utmost importance to the Alliance as a whole.

If Sam Kaplan and his associates would cease their court actions, the troubles which beset the Alliance in New York would be reduced seventy-five per cent. Reorganization of the Local and the preservation of the members' rights could be accomplished in jig time, and with a very minimum of trouble. But no; why remain passive when one's right to the title of a doer of Napoleonic deeds is questioned—even though the title be sustained by weakening that organization which made it possible to gain wealth and exert tremendous power?

Kaplan may win a few preliminary court skirmishes; but even if he wins, he loses. Locals throughout the Alliance should follow the lead of the Third (New England) District and go on record as being unanimously in back of the Alliance in its New York fight. Resolutions in support of the Alliance should come pouring into the General Office so that Sam Kaplan and his associates may know at the outset that they are fighting a losing battle in attempting to prove that one man is bigger than the organization which made it possible for them to wield such power and command such affluence. That the Alliance eventually will score a smashing victory not only over Kaplan, et al, but against those forces which flourished under the Kaplan administration of Local 306, is not to be doubted. Alliance members throughout America can make this triumph doubly sure by evidencing their support of the Alliance right up to the hilt. Mr. Kaplan's day of days is yet to come—and what a day it will be!

small part of the picture clearly, the rest being in sort of out-of-focus relation to the main spot of vision. The human eye, however, moves so quickly that it takes in the whole picture in a series of rapid glances, and the memory retains these pictures, each piece in its proper place, and the effect seems to be a whole, complete picture.

"In television the same thing takes place, the television camera rapidly scanning a scene, which in turn is reproduced in the same order by the television receivers. Of course, this scanning is much more rapid than the human eye, as the scanning spot cannot pick up as much detail as the human eye will register correctly at one instant, and so must travel faster to get in all the points.

Eye's Freedom of Movement

"Another point of difference is that the human eye needs no definite routine to follow in scanning a scene, for it may move across the top, then down to the bottom and across there, then up at an angle from the lower left to the upper right corner, etc. In television, as in anything mechanical or electrical, an accurate pattern must be followed to be repeated in rapid succession, and in order that at the receiver the same pattern may be followed and a picture reproduced which will be the same as the picture picked up at the transmitter.

"Thus, while television may seem to be a far cry from any human parallel, it actually follows the human eye more accurately in its procedure than does a camera which takes in all at once a complete picture. Eye scanning is a fascinating thing to experiment with, and should offer a lot of fun for the person who likes to contemplate television problems. Since the apparatus is already part of one's body, there is no cost involved."

A CLEVER NEW ILLUSION

THE audience of the old Roxy Theatre, in New York City, was presented with a rare treat recently, in the form of an ingenious illusion, where two shadows were cast on the screen—each performing a different stunt, yet both originating from the same individual, at the same moment.

As the curtain rises, the audience sees what appears to be a motion-picture screen. Upon this, lines are apparently drawn, by a hand unseen, representing a wharf, with a ship approaching in the background. Suddenly the shadow of a sailor appears. A hand goes up to shield his eyes, in typical sailor fashion, and he looks in all directions; then raises an arm as though hailing a second person. Presently a second shadow approaches and the two shake hands. A bottle is passed from one to the other, each apparently taking a drink; and then they go into a dance. Yet both shadows do not perform in the same manner at the same time; the audience, therefore, believes that the shadows are produced by two different people.

The scene is changed to the inside of a prize ring, and the two shadows fight

A Pass With a Laugh

"In those days there were no passes."
—Numbers 20:18.

TIBBITS OPERA HOUSE

"This generation shall not pass."
—Mark xiii, 30.
"Suffer not a man to pass."
—Judges iii, 28.

JOHN T. JACKSON, Manager

"None shall ever pass."—Isaiah xxxiv, 10.
"The wicked shall no more pass."
—Nahum i, 15.

ADMIT ONE

"Thou shalt not pass."—Numbers xx, 18.
"Tho they roar yet they shall not pass."
—Jer. v, 22.

COUNTY COMPLIMENTARY

"So he paid his fare and went."
—Jonah i, 3.

ACCOUNTS . . . .

with each other. A blow to the chin of one shadow is immediately countered with a retaliatory blow to the pit of the stomach of the other. The fighting waxes fast and furious until in the midst of the fray, the screen rises slowly and the audience can perceive that only one person has been producing both shadows.

Novel Design; Simple Execution

The stunt, the invention of a Frenchman (Harry Wills, by name, under the management of George W. Larrimore) is as simple as could be conceived. The most important piece of the apparatus is two full-length mirrors, mounted on a wheeled platform (at a "re-entrant" angle, greater than 180°, but nearly in line with each other), which is positioned at an angle of about 45° to the translucent screen, upon which the shadows are projected.

An ordinary lantern-type projector is located in the wings, also at an angle of 45° to the mirror, but on the opposite side from the screen. The secret of the shadow's production lies in the double-mirror arrangement, and in the movements of the artist before the glass. Generally, he works with his face to the mirrors but, by shifting his body either to the right or left slightly, he hides the movement of one arm, as reflected by one of the mirrors, but gives it full play in the reflection from the other mirror. A face might be reflected in profile from one mirror, when the other shows only the back of the head.

Instead of shooting his hands to his own jaw, to produce the effect of a blow, Mr. Wills extends his hands sideways from the body, one at the level of the jaw, and the other at that of the stomach; the shadows thus produced execute what appears to be a sock to the jaw, countered by a blow to the mid-section. The scenic effects are produced on glass plates in the path of the light beam.

In the stage version, two glass plates are supported on a rack, so that either may be raised to come in the path of the rays of light. Mr. Wills draws the desired scene on one of the plates, with a piece of heavy crayon; the lines cut off, leaving a shadow on the screen. On this screen, a slight, almost imperceptible line runs vertically through the picture, at the center, which marks the separation of the two mirrors. When ready for the second scene, the first glass is lowered, like a window, and the second shifted into position.

Using the same principle, it is possible to construct a toy, in which two shadows would be cast from a single *marionette* (a doll manipulated by strings); and Mr. Wills has applied for a patent on such a toy construction.—*Everyday Science and Mechanics.*

HERMAN A. DE VRY BUYS Q. R. S. DE VRY CORP.

An important recent development was the purchase of the Q. R. S. DeVry Corporation by Herman A. DeVry, Inc. With the acquiring of the Q. R. S. DeVry Corporation, Herman A. DeVry, Inc., will move their plant to 1111 Center Street, Chicago, Ill.

In taking over the Q. R. S. DeVry Corporation the new company plans a considerable increase in manufacturing schedule. The DeVry Sound-on-Film Projector will be continued. In addition, the Corporation will manufacture sound heads for theatrical machines, amplifiers, public address systems and a recently developed 35 mm. sound camera complete with amplifier to sell at a popular price. A complete service organization will handle all service and repairs on all types of motion picture equipment, sound or silent, 35- or 16 mm.

NEW FISH-SCHURMAN SERVICE

Fish-Schurman Corp., of New York, has added a special resilvering laboratory to its plant for the refinishing of used projector reflectors. Reflectors which are refinished by the F.S.C. process are guaranteed to be in as good condition as when new, and the backing thereon will not blister or peel. Projectionists are thus assured of a long-lasting reflecting surface.

The process includes complete removal of the old coatings, cleaning of the silvered surface, depositing of the new coat of silver, protection of this coat by an extra heavy electrolytic copper deposit, over which, finally, is applied a heat-resisting non-peeling backing. Reflectors that have become pitted as a result of sputtering of the carbon arc can also be reground and repolished. Further information and prices are available from Fish-Schurman.

THIRD DISTRICT MEETS AT WORCESTER

Fifty out of a total of sixty locals were represented at the semi-annual Convention of the Third (New England) District of the I.A. held at Worcester, Mass., on December 17-18. The meeting, which was held in the Hotel Bancroft, was presided over by General Secretary-Treasurer Fred J. Dempsey, who attended the Convention in company with President William C. Elliott.

Liberalization of existing "Blue Laws" was discussed at length on the Convention floor, with John Hauser of Worcester Local Union 96 leading the forces which sought immediate direct action

looking toward relief from the present laws. Since Massachusetts is the State most seriously affected by such laws, it was arranged that preliminary work on the problem should be done by an association of locals in that State. Consensus of opinion among the delegates was that the District would benefit through cooperation of theatre managers in its efforts to effect liberalization of the present stringent "Blue Laws" which have been proven to exert a very depressing influence on Sunday show attendance.

Thad Barrows, delegate from Boston Local 182, made a deep impression on the delegates during the course of a speech relative to Local Union legislation bearing on the use of double film reels. Barrows held that a continuance of present satisfactory safety conditions in motion picture theatres depended in great measure on the continued use of single reels. He urged that all Local Unions within the District and throughout the Alliance take immediate steps to insure the use of single reels through the adoption of legislation barring double reels.

President William C. Elliott, the Convention guest of honor, addressed the delegates on a variety of topics. The outstanding portion of the Presidential address was that referring to the present serious problems affecting the Alliance and the power which each Local Union possessed in cooperating with the General Office on matters which ultimately affect the good and welfare of every unit in the Alliance. Evidence of the high regard in which President Eliott is held by members of the Third District was had in the vociferous applause which greeted the conclusion of his address. General Secretary-Treasurer Fred J. Dempsey, a member of the Third District for many years, delivered an informal neighborly talk.

James J. Finn, editor of INTERNATIONAL PROJECTIONIST, spoke briefly on various topics, among which was that of the relation of projectionists to sound picture equipment servicing. Thad Barrows again took the floor as President of the Projection Advisory Council to direct the notice of the delegates to the fine work of this organization during the past few years and to ask for continued cooperation.

The Third District adopted a resolution endorsing the action of President Elliott and the entire General Executive Board of the Alliance with respect to the handling of the Local Union 306 (N. Y. City) situation. The resolution was adopted unanimously. The next District meeting will be held June 6 in Boston. Delegates to the Convention were:

Massachusetts:

11, Boston—James J. O'Brien; 36, Lowell—N. R. (not represented); 53, Springfield—D. J. Haggerty, M. J. Casey; 57, Fall River—William A. Dillon (District Sec.-Treas.); 73, Lynn—W. C. Scanlan; 83, North Adams—N. R.; 86, Fitchburg—N. R.; 89, Holyoke—William A. Hancock; 96, Worcester—John Hauser, John E. Murphy; 111, Lawrence

W. E. SUES ULTRAPHONE CO. ON GRID BIAS

THE Western Electric Company has brought suit for patent infringement against Ultraphone Sound System, Inc., of Minneapolis, Minn. Named as co-defendant is the Twin City Theatre Corporation owning the Princess Theatre, Minneapolis, Minn., which has an Ultraphone installation. Papers in the action have been filed in the U. S. District Court, District of Minnesota.

The suit is based upon the Lowenstein Patent, No. 1,231,764, covering negative grid bias amplification to prevent distortion. This patent was declared valid and infringed in a recent decision of the Court of Appeals for the Second Circuit in an action brought by the Western Electric Company against Sol Wallerstein of the Broadway Theatre, Buffalo, using

Pacent equipment. This suit was defended by Warner Brothers.

—Maurice Fitzgerald; 131, New Bedford—Fred C. Burns; 149, Brocton—N. R.; 182, Boston—Thad C. Barrows, James F. Burke, J. H. Fullick; 186, Springfield—John F. Gatelee, J. Louis Lambert; 196, Salem, Ben H. Chatel.

Also: 232, Northampton—James B. O'Neill; 245, Salem-Lynn—Leo F. Barber; 256, Lawrence—Joseph Bell; 275, Pittsfield—Clifford Williams; 334, New Bedford—Thomas—J. Maloney; 381, Haverhill—Fred Penwell; 382, Holyoke—David Taylor; 397, Haverhill—Fred L. Taylor; 424, Fall River—Richard Ironfield; 437, Brockton—John L. Creed; 452, Pittsfield—George H. Bissell; 454, Attleboro—Thomas C. Johnston; 505, Waltham—P. J. Doheny; 546, Lowell—Sidney Le Bow; 549, Taunton—N. R.; 596, Greenfield—William Merrigan.

***Connecticut*:**

74, New Haven—N. R.; 84, Hartford, R. K. Lewis, H. F. Sweet; 88, Waterbury—J. A. Clealand; 109, Bridgeport—Joseph Kenna; 273, New Haven—R. P. Van Arsdale; 277, Bridgeport—James V. Fensore, 301, New Britain—Howard Williams; 304, Waterbury—N. R.; 350, Meriden-Middletown—Thomas J. Shea; 402, Torrington—Michael J. Scanlon; 439, New London—W. Lucas; 449, Stamford—Nicholas Trimboli; 453; Willimantic—John Moran; 459, Norwich—N. R.; 479; Norwalk—George Brazil; 486, Hartford—L. H. Stagg; 662, Danbury—Irving Lown.

***Rhode Island*:**

23, Providence—Fred Newcomb, Joseph Prew; 223, Providence—Herbert F. Slater, John Ford; 309, Newport—N. R.; 538, Westerly—Gerald H. Payne; 579, Woonsocket—Albert Crepeau; 677, West Warwick—Clarence T. Duffy.

***Maine*:**

114, Portland—N. R.; 198, Bangor—Albert E. Pierce; 458, Portland—Wilbur J. Vasjon; 624, Lewiston—C. C. Coffin.

***New Hampshire*:**

195, Manchester—Samuel Cooley; 685, Concord—Bradley Callahan.

NOISE SOURCES AFFECTING SOUND REPRODUCTION

(*Continued from page* 9)

step further, suppose that lack of attention to port and door details in this last wall resulted in a total area of one square foot of direct air leakage. The apparent transmission reduction would now be only about 23 decibels, 18.5 decibels less than previously. The importance of paying attention to details is therefore obvious.

Projection Room Construction

As regards the construction of projection rooms in new theatres, or their modification in existing theatres to fulfill noise reduction requirements, a number of factors are involved. Whereas a heavy masonry construction, which would provide adequate sound insulation, could be specified, it is frequently found that

either the weight of such a structure is excessive or the cost is prohibitive. However, where the allowable weight is limited, there are a variety of non-homogeneous materials that may be used in the construction that will provide adequate sound insulation and will be generally satisfactory as regards the structural requirements involved.

Experience has shown that special composite sound insulating structures will, under certain circumstances, provide sound insulation equivalent to that of the usual homogeneous masonry structures. However, the advantages that may be gained by using such structures are contingent upon the circumstances under which the structures are to be used. No specific recommendations on the use of such structures can be provided without exact knowledge of all the influencing factors.

Relative to the problem of isolating vibration that may be created by any part of the projection equipment, certain fundamental factors must be carefully considered. In general, the isolation of vibration consists in providing a supporting structure that is capable either of dissipating the vibration energy transmitted into it, or of otherwise effectively acting as a barrier to its transmission. Such a supporting structure must be designed for each individual vibrating source, if the vibrations are to be successfully isolated.

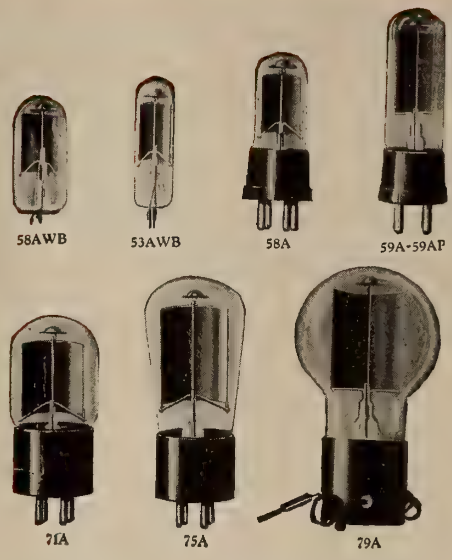
In designing isolating structures of simple form, it has been found desirable to make the natural frequency of the mounting, as loaded by the vibrating source, at least one-fifth the lowest frequency of vibration to be eliminated. The proper combination of mass, stiffness and resistance may be determined for which the transmission of vibration will be reduced to any desired degree, and at the same time fulfill such other special requirements as may be involved. In general, the design of a satisfactory vibration isolating system to be placed beneath a projection machine requires knowledge of the distribution of mass, the frequencies of vibration, the available floor area, and the types of material that will satisfactorily fulfill the particular requirements.

In new theatres, or in existing theatres where extensive modifications of the floor structure of the projection room can be made, a highly satisfactory solution of the vibration problem is to mount all projection equipment on large concrete bases, which in turn are isolated from the building structure in accordance with the usual basic principles of isolation. By so doing, the mass of the concrete base adds stability and reduces the likelihood of fluttering of the picture during projection, as might occur with a more lightly loaded elastic support. Such pecautions are particularly advisable for avoiding the effects of shock sustained by the equipment while it is being handled or adjusted during projection.

Similar principles should be applied in isolating other pieces of projection equipment, particularly motor-generator sets. By properly isolating the various vibrating elements, many noise problems common to theatres can be solved without difficulty. However, it should be remembered that an isolating material does not of itself make an isolation foundation; proper consideration must be given to all the factors involved in the problem, and a design must be evolved that will satisfactorily fulfill the particular requirements indicated.

Although it may appear that theatre noise problems are difficult to overcome, it has been found that by paying attention to details and by applying the basic acoustical principles, satisfactory reductions of the theatre noise level can be achieved. In the case of new theatres, fewer difficulties are involved, as the necessary modifications in design can be readily made in order to fulfill the indicated requirements.

It is apparent, however, that the real solution of the theatre noise problem lies in the development of much quieter equipment. It is anticipated that in the very near future, specifications for the purchase and installation of theatre equipment will include a clause on the maximum permissible noise level that may be created under certain specified conditions. To this end, the further development of quieter theatre equipment by the manufacturer is determined by the interest of the exhibitor and the demands of the public for better acoustical conditions in the theatre.



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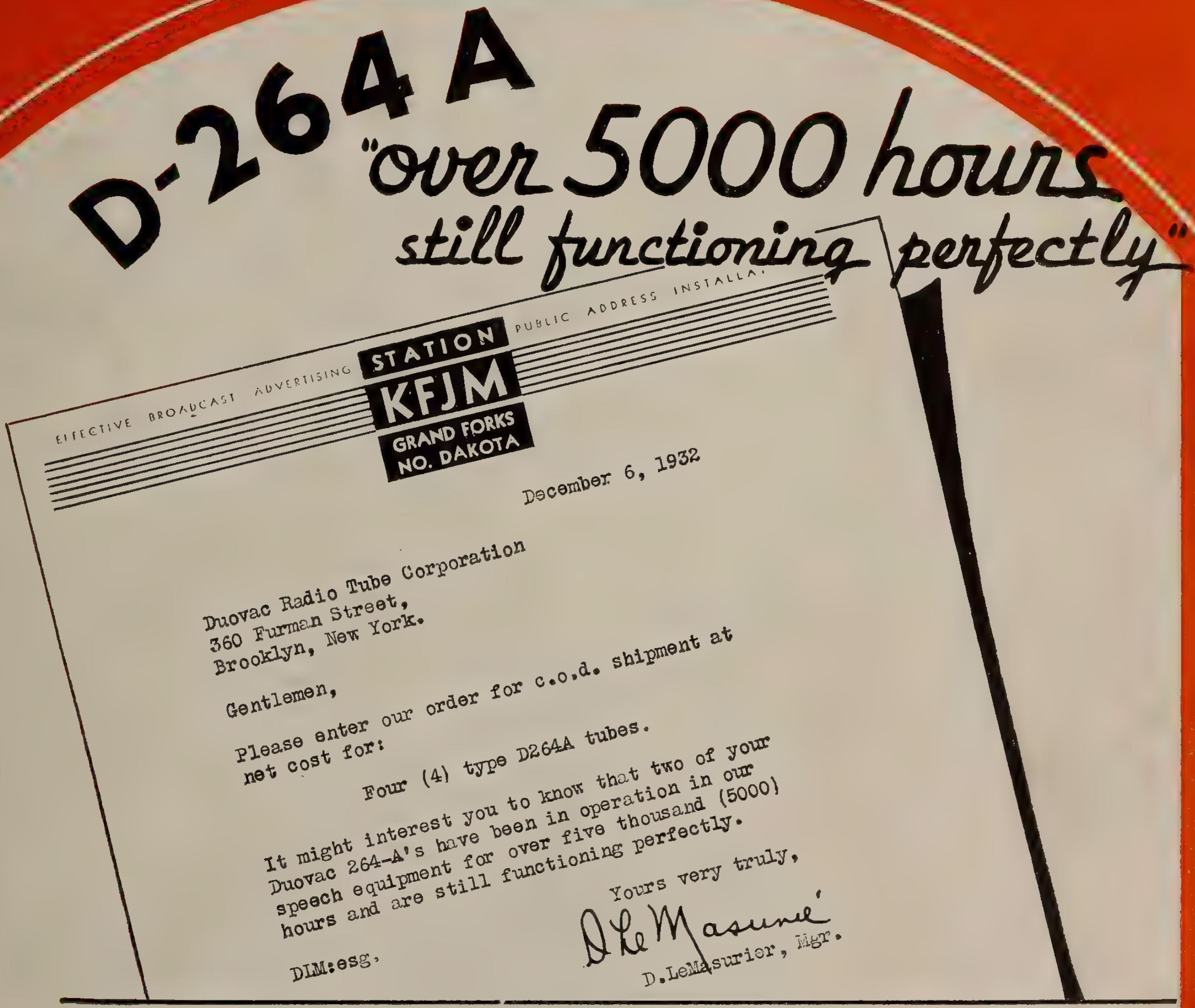

December 6, 1932

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Vol. 4, No. 3
January 1933

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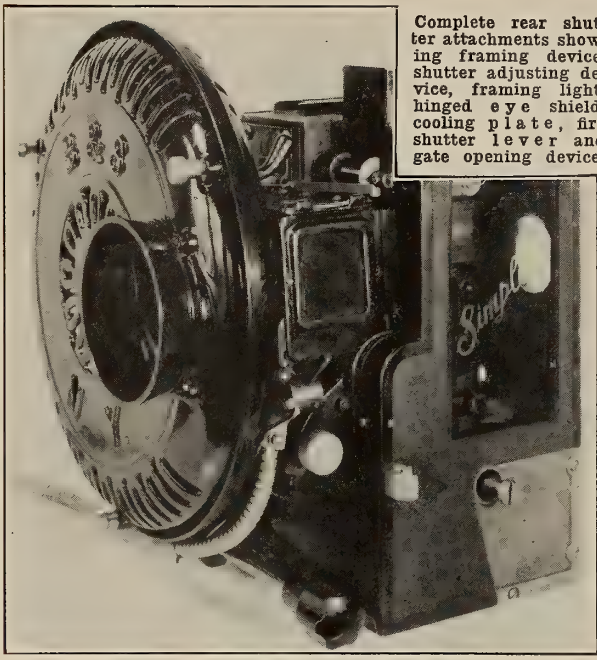
TWO NOTEWORTHY ACHIEVEMENTS IN PROJECTION EQUIPMENT



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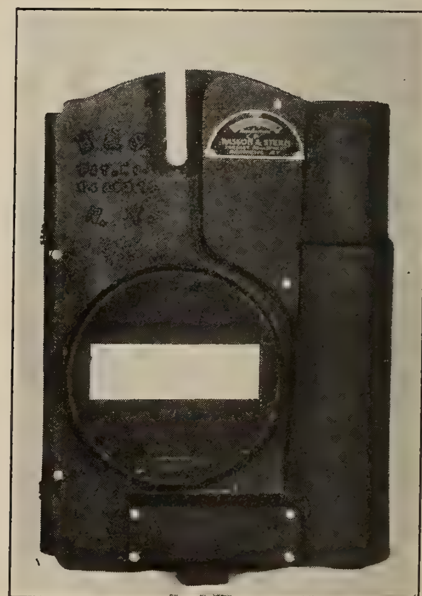

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Edited by James J. Finn

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MONTHLY CHAT

LOST, strayed, but positively not stolen: one exceedingly furtive proposition which answers to either name of "High Fidelity" or "Wide Range". Substantial reward. No questions asked. Finder will please communicate with either or both RCA Photophone or Western Electric Co. Offices in all principal cities.

. . . All of which merely goes to prove that a drooping frequency curve in a theatre amplifier may have its disadvantages, but said disadvantages are as nothing compared with those which inevitably accompany falling attendance and a diminishing bankroll.

FILM reel lengths of 1,700 feet, masquerading under the alias of "double reels", are promised for the near future. How anybody can term 1,700 feet of film a double reel is beyond us. But then, they call those THOSE THINGS they are producing these days in Hollywood, "motion pictures". The phenomenal success of *Animal Kingdom* at the box-office is further proof that what the industry needs is less talk about labor and radio and television and relatives and more talk about good pictures and how to make them. Of course, the presence of relatives automatically sets up an insurmountable barrier to the making of even one good picture.

THE servicing of sound systems by projectionists is readily translatable in terms of dollars and cents, as was evidenced by the flood of requests for copies of our last issue, which disposed of this provocative topic with neatness and dispatch. To the injury already sustained by those unable to secure their copies we shall add insult by saying that many other topics in many other issues of I.P. may be utilized to secure additional dollars and cents. Keeping what one has is ever so much more satisfying in the long run (particularly to the grocer and the landlord), than loosing one's grip on the present in order to chase the future. Catch on?

We regret being unable to print each month a story about Sam Kaplan, and lawyers, and $800,000, and courts, but this obviously is what sells magazines. For shame.

RANDOM Thoughts: Receivers for Paramount and RKO will get right down to work on contract-busting and lease-cracking. Be careful. . . . Two-men legislation is now pending before seven state legislatures. Thirty-six would be the safer figure, based on the law of averages. . . . Don't ever try to sell the UNION. Sell better and safer projection work by UNION MEN. . . . We fight for two men; and many projectionists suddenly develop headaches which require their presence in the corner drugstore—thus proving us wrong. A fine of about $500 would not be too much for such an offense. . . . Study your sound equipment thoroughly—NOW.

INTERNATIONAL PROJECTIONIST

VOLUME IV NUMBER 3

JANUARY 1933

THE MAINTENANCE OF MOTOR GENERATORS

A. C. Schroeder

MEMBER, LOCAL UNION 150, I. A. T. S. E., LOS ANGELES, CALIF.

THE first consideration in the maintenance of motor generator sets is lubrication. There must always be plenty of clean oil. Only mineral oil is used in these machines; animal or vegetable oils are not satisfactory. Everyone knows what the lack of oil will do: overheated bearings, premature wear, scored journals, ruined bearings. Dirt in the oil has much the same effect. Dirt is a cutting agent, embedding itself in the softer metal and then scratching the other surface against which it rubs.

Oil that is too heavy will not allow the oil rings to rotate when the temperature is very low, thus "starving" the bearings. A light oil is the proper one to use, so that it flows freely even in the coldest weather. Keep the oil even with the top of the cups that are on the sides for checking the level. Notice if the rings are revolving, and whether ample oil is being carried up by them.

Oil should be changed about every six months. If it comes out black and dirty, fill the bearings with clean oil and then drain it out again after running the machine a little. Do this until the oil comes out clean.

In the case of overheated bearings on one of the smaller machines, slow it down if possible, but do not let it stop, as it is likely to stick. On a large machine it is safer to keep it running than to take a chance of it "freezing up." Flood the hot bearing with clean oil. Do not use water under any circumstances. It takes time to cool a bearing, as there is a large amount of metal that is overheated.

Overheated Bearings

When a bearing overheats something is radically wrong. In a new machine this condition is not surprising, but when it occurs after a machine has been running well for some time, it is usually due to neglect or carelessness. Some causes of overheating are: a scored shaft, bent shaft, bearings too tight, bearings improperly fitted although not tight, bearings out of line, oil ring stuck or broken, lack of oil, dirty oil, diluted oil (water, coal oil or some other substance in the oil), and overloaded bearings. An overloaded bearing is a rare occurrence, except in a belt-driven machine where the belt is too tight. When bearings are out of line it really causes an overloaded condition, but this is not thought of in that way.

The remedy for any of these conditions is obvious. When a shaft has been scored it is important that it be put in condition before being used again.

A commutator that is in good condition will be dark, very smooth and shiny. By dark I do not mean black. A black commutator will not be smooth nor will it shine; something is wrong. When it appears as at first mentioned it is easy to take care of. Never touch it with sandpaper. A lubricant must be applied *sparingly* and not too often. There is much discussion as to what is the best lubricant. I have used both vaseline and oil, but I cannot see any great difference between the two, although I favor oil. A small amount is put on a cloth and applied to the commutator while the machine is running. Spread the lubricant over the entire surface. This will be enough to lubricate, yet there will not be enough to cause trouble.

A burned, dirty, or rough commutator should be sanded, unless it is out of round, in which event it must be turned down. Use fine sandpaper, and (we repeat what has been said hundreds of times before), *never use emery cloth.* Sanding is usually not the only thing to be done in this case; the cause of the trouble must be found. The possible causes are numerous: brush tension too heavy or too light, brushes sticking, improper brush contact, some of the brushes disconnected or not touching the commutator on machines having two or more brushes in parallel, thus overloading the remaining brushes; out of round commutator, high or low bar in commutator, high mica, grounded or shorted

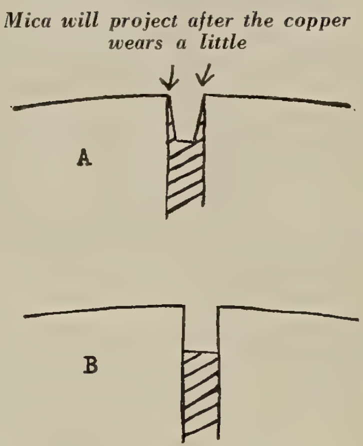


FIGURE 1

commutator bars, open or short-circuits in the armature, and a grounded armature.

Loose bearings may cause commutator trouble, as will an overloaded machine. Some of the above troubles may cause the solder to fly out of the commutator.

Projectionist's Responsibilities

Not all of these troubles can be repaired by the projectionist. Brushes can be fitted and adjusted, also freed up in the holders; brush tension can be adjusted; "shorts" in the commutator can be found, such as metal particles lodged between the bars; sometimes "shorts" and open circuits can even be located and repaired in the armature, but usually these will have to be sent out. When the commutator is out of round, or a segment is high or low, it must be sent out to be repaired.

Ridges and uneven wear can be corrected by the use of special stones. They are mounted in holders with a handle on them and are applied to the commutator while the machine is running. Stoning is continued until all ridges and uneven surfaces have been removed. The commutator can be put in good condition this way, if it is not out of round.

Undercutting the Mica

The mica must be inspected after stoning the commutator. It must be well below the surface of the copper bars. It will probably be necessary to undercut the mica, which is done with a tool similar to that shown in Figure 1. A piece of hacksaw blade is used, one end being wrapped with tape so it can be held without injuring the hand. It often is necessary to grind the sides of the teeth so they just fit the space between segments of the commutator. The tool is moved back and forth on top of the mica, keeping the blade between the segments. Work carefully, as the blade has a habit of leaving the groove and cutting a deep scratch across the face of the commutator.

Figure 2 shows the right and the wrong way of doing this job. The cut shows two commutator bars and the space between them. At *A* is an improperly undercut mica, shown by the shaded portion. At *B* the mica has been cut down clean on both sides of the groove and the top of the mica is well below the surface of the copper. When a commutator is undercut as at *A*, it requires only a little wear of the copper before the mica at the two corners of the segments will be flush with the copper. The mica does not wear as rapidly as the copper and from then on it will protrude further and further, partially holding the brushes away from the commutator, thus causing sparking and more rapid wear and burning of the copper bars.

After undercutting, sand the commutator with fine paper, blow away the dust with bellows and oil the surface lightly.

Fitting & Adjusting Brushes

When commutator and brushes are in good condition they do not require much attention. The brushes should be worked up and down in their holders occasionally to see if they are free and are not sticking. At the same time notice the tension. As the brushes wear, the tension becomes less. The tension cannot be judged if the brush is sticking, thus the first thing is to free the brush. If any doubt exists as to whether or not the brush is free, remove the spring while the brush is worked up and down in the holder.

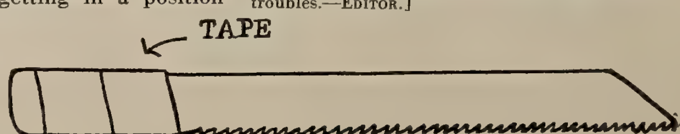
Sticking is nearly always due to a gummy deposit on the brush or in the holder. After cleaning both the brushes and the holders the brushes should be put back in their respective holders, because it is almost impossible to have all the holders adjusted exactly alike. When the brush is put back so that it strikes the commutator at a new angle, it will not fit properly.

The tension can now be adjusted. Too much tension is undesirable because of excess wear, also because the commutator runs at a higher temperature due to increased friction. Not enough tension causes the brush to vibrate, and the contact between it and the commutator will be poor, causing sparking and also heating and wear of the copper.

Probably the best indication of the brush tension is sparking or absence of sparking. There are, of course, other things that cause sparking; nearly all armature troubles show up in this way, as does overloading of the machine. When the machine is running perfectly and is delivering a normal load, there should be only the very faintest trace of a spark at the brushes. It usually is visible only when getting in a position so that one can look almost right between the brush and the commutator. The sparks will be very small and extend clear across the width of the brush, and all the brushes will have the same amount of sparking. When pressing the brush against the commutator lightly results in considerable decrease in sparking, the tension should be increased. If this does not cause much change, the tension is probably sufficient. Try decreasing the tension a bit, and if this results in increased sparking the tension has been too light. The idea is to get just enough tension to reduce sparking to a minimum and then increase it a trifle in the interest of safety.

[NOTE.—In the concluding article of this series, to appear next month, Mr. Schroeder will discuss other aspects of m.g. maintenance, including the proper fitting of brushes and armature troubles.—EDITOR.]

Figure 2



RECEIVERS FOR PARAMOUNT; RKO THEATRES, TOO

ADMITTING through its attorneys that it lacked liquid assets with which to meet current obligations, Paramount-Publix Corporation, one of the leading producing, distributing and exhibiting units in the industry, was placed in equity receivership by Federal Judge William Bondy of the Southern District of New York. The receivers appointed are Adolph Zukor, president of the corporation, and Charles D. Hillies, Republican National Committeeman.

At the same time Publix Enterprises, Inc., a subsidiary of P-P, entered a voluntary bankruptcy in which the Irving Trust was appointed receiver.

Cite 'Beneficial' Results

Paramount-Publix officials stated that in the long run the receivership should prove "beneficial" through the ability of the receivers to effect sharp reductions in fixed charges, the present high level of which is traced to numerous real estate deals and theatre leases written during '28, '29 and '30. Corporation officers stated that the assets of P-P were $166,000,000. The status of labor contracts under the receivership has not been ascertained as yet.

Following the lead of Paramount-Publix, certain RKO subsidiary theatre operating groups entered voluntary receivership. About 60 theatres, mostly in the South and far West, are affected by the move.

SONOLUX N. Y. DISTRIBUTOR

The Sonolux Company, manufacturers of Sonolux Exciting Lamps, has announced the appointment of the George Hornstein Co., 324 West 42nd St., New York City, as distributors of its product in the New York area.

Projectionist Servicing Plan Sweeps The Country

Many Local Unions report enthusiastic exhibitor acceptance of plan. Many theatres already using projectionist service

GENERAL approval of the plan for projectionist servicing of sound motion picture equipments as presented in INTERNATIONAL PROJECTIONIST is indicated by the number and tenor of letters received from all sections of this country and Canada. Comment was had not only from projectionists but from several exhibitors as well, all of whom unqualifiedly endorsed the plan. An exhibitor organization also gave its approval.

No definite information anent the attitude of sound equipment companies toward the plan was received.

A surprise was provided by the news from nine Locals to the effect that they already have several theatres on their respective servicing lists, the work having been handled to date to the complete satisfaction of the theatres. Other Locals indicated that the article in I.P. provided the spark which transformed thoughts about the matter into action, with surprisingly fine contacts resulting from the initial organizing efforts.

Typical of the more enterprising Locals is a letter from San Francisco Local Union 162, which has repeatedly proven its pioneering abilities in the advancement of the craft's interests, stating that projectionist sound system servicing is a matter which has had their serious thought for more than a year and that the plan actually had been put into operation some six months prior to its general release in these columns. From W. G. Woods, Secretary of 162, came the following informative letter:

We were very much interested in your article on projectionist sound servicing for the reason that we had "beaten you to it" by about six months and therefore knew your arguments to be sound and timely. Not only on this count were we interested but also on the score of a desire to lend impetus to such a movement on a national scale. You have removed this latter worry.

When RCA announced its policy of outright sale and the abolition of compulsory servicing, we took over one of the engineers who had been doing service work in this territory, paid him a regular salary from the Union and, with the knowledge and consent of RCA, advised all exhibitors whose contracts were out or nearly out that we would take over this service and furnish them with equally good service by the same man—and at a greatly reduced price. Needless to say, this proposal evoked considerable enthusiasm among exhibitors.

At first we went into "the red" in this matter, as we fully expected to do, but included in this "red" was an item of several hundred dollars for a complete test set which we had built for our engineer. This engineer was an I.A. projectionist of ability, a member of an Eastern local, and we could therefore use him for short jobs and relief work—all of which added to his income. We know that this move will prove to be a good investment as time goes on and other houses avail themselves of our service.

In addition, our own men now feel absolutely no hesitancy in approaching this man for advice and help on any sound picture problem, a condition which was by no means general previously. Forgetting all this, the fact remains that you hit the nail on the head when you said that such a move is purely defensive, in that it serves to keep outsiders out of the projection room. This advantage alone is worth whatever the cost may be.

Eight other Locals approached the San Francisco record of early action, while other units, notably Pittsburgh, announced that plans are practically complete for early assumption of servicing work. Scores of Locals sought advice as to the best method of organizing a sound servicing department, the lack of competent manpower being particularly

(*Continued on page* 22)

Two-Men Operation Looms As Sizzling Controversy

Bankers launch well-organized drive to eliminate second man from projection room. Report in preparation

LEGISLATION compelling the use of not less than two men in projection rooms is now pending in seven states within the United States, and the topic is being considered by the National Research Council for the entire Dominion of Canada. This is the answer of projectionist organizations to the frantic efforts of producer-exhibitor organizations and bankers to lower costs through the elimination of manpower in projection rooms, irrespective of the strict requirements of good projection and safety.

Current labor disturbances in Canada may be traced directly to the fact that Canada was selected as the first scene of operations for a combination which is seeking to jam the one-man shift idea down the throats of both the amusement industry and the public which pays the bills for that industry. Canada was the locale chosen for the first big push against two-men shifts, and it was there that the first dollars out of a preliminary appropriation of $100,000 to fight for one-man shifts were spent. The hokus-pocus started in Canada last July, and the sponsors for the one-man shift thought that certainly by January 1 last this territory would have been nicely cleaned up. But they were mistaken: for the Canadian projectionist organizations fought back and hung on to their hard-earned conditions with an amazing tenacity.

There exists in New York City today a law firm which handles only banking accounts. One department of this law firm concerns itself exclusively with labor matters, and it was to this department that the original plans for the one-man drive were sent. Mr. Banker has many millions of dollars invested in this so-called amusement business of ours (a business in which the leaders provide more amusement than could possibly be crowded onto even the largest theatre stage), and Mr. Banker is very anxious to get as many of his dollars out of this industry as he possibly can. One man projection shifts is one of his ideas for protecting all these invested dollars.

In the Kaplan court cases recently concluded in New York City there figured a representative of this law firm previously mentioned. Every day, no matter what the occasion or which the court, this legal representative of Mr. Banker was in court—and not as a spectator. He worked—to no avail, probably—but work hard he did. That which definitely showed the hand of this smooth lawyer was his ability to approach and induce to testify those people who previously had resisted all attempts to get them to tell what they knew —and their resistance invariably stiffened in the presence of a Grand Jury.

But when Mr. Banker's lawyer visited them and possibly recited the difficulties attendant upon operating a theatre circuit or getting along generally in this world without the aid of a bank, these dumb witnesses suddenly became very voluble and trooped off to court without further urging. This little recitation served its purpose in the case of several witnesses. It costs money to operate any business, and it seems desirable these days that an alert business man maintain excellent contact with bankers.

These statements are based on facts, not fancy. Everybody

(*Continued on page* 22)

COLOR SYSTEMS MUST RECOGNIZE PROJECTION REQUISITES

Geraldine Geoghegan

THE E. S. S. COLOR FILTER CO., LONDON, ENGLAND

***Renewed activity in color film production, particularly with respect to short subjects (two reels or less), serves to focus attention upon this medium as a means for providing the box-office "punch" which is generally held to be necessary to a reawakening of public interest in the art. Heretofore, production processes have monopolized the attention of color film technicians, and projection has been thought of only in connection with ways and means to compensate for inherent deficiencies in a given process. Directly opposed to this procedure is the opinion expressed in the accompanying article, presented to the S.M.P.E. in 1931, which advances the claim that no color film system may hope for wide acceptance until it provides specifically for the projection process.* — **Editor.**

MOTION pictures in natural color seem to have developed in a somewhat jerky fashion. It is quite common among the various concerns dealing with color to have an expert on one or two subjects concerning the many problems arising in natural color photography, but, generally speaking, these experts are concerned only with their particular specialized knowledge and can offer little or no help when outside problems upset their calculations.

If the color is produced by an optical arrangement, an expert in optics is employed; if by dyes, a specialized color printer, etc. It is quite possible that these men can, and do, produce motion pictures of astounding beauty and fidelity to color under the *standardized conditions of the laboratory*; but when these prints are used commercially considerable trouble arises.

When we consider that color is not part or parcel of the article observed but merely its capacity to absorb and transmit such part of the light waves that fall upon it, we are up against our first problem—the spectral quality of the "taking" light. If the latter wavers in wave-length in the slightest degree, the object being photographed changes its hue. At the same time the human eye is an accommodating organ and has a very short memory, so that if such changes be gradual, it is impossible to notice them while under the influence of altered light; but, if the same observer and object again be placed under the correct light with an image taken under deficient light, the error can be detected immediately.

It is common knowledge that it is very difficult to produce artificially a light with a spectral approximation to daylight of sufficient volume without heat and noise. Even if this be done, the motion picture producer of color films is immediately up against another problem, the spectral quality of the "projecting" light.

After all, a color transparency is merely a collection of light filters that absorb and transmit, according to their power, the light that is projected through them. Therefore we can deduce from this, that to obtain pictures on the screen in natural color, the "projecting" light and the "taking" light must be one and the same spectrally. Compensation may be attempted, but all filters lower the volume of illumination.

Let us say, for the sake of argument, that we have our taking and projecting lights spectrally balanced: minor problems now arise, such as the absorption and transmission of the screen, the influence of color in the decoration of the theater, and the general quality of the approach lights. Some attempt should be made to screen all interior lights so that they approximate in quality that of daylight where neutral color films are to be shown, and only subdued schemes of decoration should be permitted.

The problem of voltage plays a part in projecting that does not arise with monochrome work. It would be quite possible for a motion picture in natural colors to be shown in one theatre with exceedingly pleasing and beautiful results, while its exact duplicate might be shown elsewhere with distorted and repulsive colors, owing to a drop in voltage.

One has to consider that on the stage, where living actors and actresses appear, the colors of the dresses and the lights that play upon them are under the control of the producer. He views the effect as the audience sees it, and is certain that no radical change can occur; but the producer of motion pictures in color is by no means in that happy position. Monochrome pictures, once passed by their director and shown under ordinary standardized conditions, will please the man in the street even if the expert technician will notice an error or so. But with natural color pictures it appears that a private view is necessary in every theatre in which each motion picture is shown, to see that no unforseen spectral change has occurred.

It was found that many theatres were not suited for the sound pictures; some even had to be scrapped, and many altered. Why not, then, take the same precautions with color?

Undoubtedly color pictures will take the place of monochrome; but only by a very strict attention to what may be looked upon as minor details, can success be obtained. A change in gradation of tones in a monochrome picture can occur without any appreciable notice on the part of the spectator, but a change in color will be seen by every two out of three. The normal vision is trained to recognize objects not only by shape, but by color; it is not really familiar with these in monochrome, and therefore allows false gradation to pass unnoticed.

The writer has purposely ignored such problems as fringing, etc., as these are inherent in the processes themselves, and has adopted, merely as a theme, the difficulties that confront the producer, even though we have a perfect process of motion picture in color. It is doubtful whether such a process is yet on the market commercially, whence the path for color cinematography is beset with many thorns and snags. But at the moment it is felt that too much thought and research work are being directed to emulsions, optics, etc., which, although of themselves invaluable, are useless unless the same care be taken with light, etc.

It would be a better box-office proposition to have color fantastically unreal than to show (as has been done in many cases), true color degraded and falsified by bad technic.

MERCURY VAPOR RECTIFIERS

Eugene L. Bruyning, Ph.D.

CHIEF ENGINEER, DUOVAC RADIO TUBE CORPORATION

THE meteoric rise of the gaseous rectifier, particularly in the form of the mercury vapor rectifier, has deluded many as to its real status in the electronic art. To the gaseous rectifier rightfully belongs the unique distinction of being the first electronic device. The classical experiments of Preece and others would have been fruitless were it not for the part that gaseous conduction played.

In order to properly describe the mechanism of the mercury vapor rectifier it will be necessary to reiterate various physical phenomena as well as the behavior of the vacuum rectifier.

Emission from Hot Bodies: Matter supposedly consists of minute particles called *atoms*, which in turn consist of particles of negative and positive electricity. These ultimate particles are identical, irrespective of from what material they have been derived. It is not only the quantity but the arrangement as well of these particles in the atom that determines the physical and chemical properties of any particular piece of matter. There are always exactly the same amount of electrons as protons in a neutral atom. If an electron is removed from an atom, the number of protons predominate and therefore the atom behaves as though it were positively-charged. If, on the other hand, an electron is added to an atom, the atom will behave as though it were negatively-charged.

Electrons can be readily removed from atoms, if the atoms are subjected to heat. In other words, if a piece of material is heated, electrons leave the atoms of which the material is composed, move between the atoms and may even leave the piece of material entirely. This is called the *electron emission from hot bodies*.

It is not amiss at this point to remind the reader that like charges repel each other; while unlike charges attract each other. When electrons leave a piece of hot material, the material becomes positively-charged, due to the loss of these electrons, and therefore attracts the emitted electrons back to itself.

Conductors and Insulators

If current is readily conducted through a piece of material, that material is termed a *conductor*. If, on the other hand, current does not flow through a piece of material, that material is called an *insulator*. Perfect insulators do not exist. Conductors differ widely as to the ease with which they will pass current. Some conductors will resist the passage of current more than others. Insulators offer tremendous resistance to current flow. A commonly accepted theory is that current is conducted through a medium because free electrons are present between the atoms of that medium. Conductors, however, generally are neutral, so that we are forced to assume that positively-charged atoms are present to neutralize the negative charge of the elecrons. This assumption is based on the fact that protons cannot exist in a free state. Posiiively-charged atoms are called *positive-ions* or, more commonly, *simple ions*. A conductor is therefore simply a medium where electrons as well as ions exist beside the neutral atoms. The relative quantity of the ions and the atoms determines the resistance of any medium.

Ionization: When any portion of the atoms of a medium is split into electrons and ions, that medium is said to be *ionized*, and the process by which this is accomplished is termed *ionization*. If an electron is hurled with sufficient force against an atom, it is possible for that electron to dislodge one or more electrons from the atom. This is called *ionization by collision*, and it is this type of ionization which we shall consider in this article.

An ionized gas, according to the previous information, consists of gas molecules, ions and electrons, and this is the same condition that exists in conductors.

Mercury vapor tubes assuredly are not new, but their comparatively recent introduction into the sound projection field invites investigation by projectionists relative to their production and their operating characteristics. The step-by-step development of this type tube is traced in the accompanying article, the first of a series to appear in these columns. Dr. Bruyning will gladly answer in an appendage to his next article any questions relating to tube manufacture or operation.—Editor.

An ionized gas is therefore a conductor, and it is this property which makes it valuable in gaseous rectifiers.

Two-Electrode Vacuum Tubes (Diodes)

A diode consists of an emitter called *cathode*, and a collector called *anode*, both of which are sealed into an evacuated vessel. The words "cathode" and "anode" are synonymous with the words *negative* and *positive* electrodes, respectively. The cathode, by virtue of its temperature, emits electrons. Although these electrons travel great distances from the cathode, if their size is taken into consideration, in reality they travel only a few millimeters. They soon expend their energy and fall back into the cathode, which has acquired a positive charge due to the loss of them. If a positive potential, however, is applied to the anode, the liberated electrons from the cathode will continue to travel if the attracting force of the anode potential is sufficient to manifest itself in the region where they have almost expended their energy.

A continuous stream of electrons is therefore established between the cathode and anode which will persist as long as the anode remains sufficiently positive.

The electrons which travel from the cathode to the anode exert a repellent force on those which have just emerged from the cathode, so that the latter are retarded in the neighborhood of the cathode. This retardation results in the massing of electrons in the neighborhood of the cathode. The current flow between the electrodes is seriously hampered by this mass of electrons. Let us for a minute, however, ignore the limitations of this device, and consider its usefulness as an industrial appliance.

If an alternating current is applied to the anode of a rectifier, electrons will flow from the cathode to the anode only at times when the anode is sufficiently positive in respect to the cathode. We here at our command, therefore, a device that conducts current *only in one direction*. Let us now consider all its limitations.

The amount of current that can be conducted will depend on the following factors:

1. The emissivity of the cathode. In other words, the amount of the electrons that is emitted by the cathode in unit time.

2. The distance from the cathode to the anode. This distance determines the force of attraction that the anode will

exert on the emitted electrons for any given potential. It is true that this potential can be raised sufficiently to attract all that are emitted by the cathode. High potentials, however, must be used with caution, in order to prevent flash-over from the anode to the cathode.

3. The space charge within the device. It was shown before that the electrons traveling from the cathode to the anode exert a repellent force on the electrons which have just emerged from the cathode. The aggregate charge of all the electrons in the space between the electrodes is called the *space charge.* This particular limitation is by far the most serious and determines the resistance which the device offers to current passage for all comparatively low voltages. If the charge of these electrons could be neutralized without actually removing the electrons, or even if it could be partially neutralized, an increased current flow would take place. Such a neutralization can be accomplished.

Gaseous Rectifiers

Let us consider what will happen if we place a small quantity of any gas within a diode. The electrons emitted from the cathode while traveling to the anode will undoubtedly collide with some gas molecules. In some instances they will collide with sufficient force to dislodge electrons from these gas molecules, especially if the anode potential is high enough to accelerate the electrons sufficiently. The gas molecules which have been deprived of an electron will constitute postively-charged bodies within the space between the cathode and anode, and therefore will, to a certain extent, neutralize the space charge. Moreover, the dislodged electrons will join the emission electrons in their travel to the anode and substantially increase the anode current. The ions will be attracted toward the cathode, and somewhere near the cathode will re-combine with electrons to again become neutral gas molecules.

Extreme caution must be used as to the nature of the gas employed for gaseous conduction. It will readily be seen that active gases, such as oxygen, will chemically combine with the material of the cathode and eventually render it inoperative. Therefore, only gases which will not attack the cathode material should be employed. Such gases are called *inert gases.*

Some of the gas ions never re-combine with electrons, but fall into the cathode —in other words, *bombard it.* Only gases which have an ionization potential below twenty volts will not seriously damage the cathode. Mercury vapor admirably fills the requirements.

It is a well-known phenomenon that evaporation of liquids takes place at any temperature, so that, if we should place a small quantity of mercury in a well-evacuated vessel, the whole of the vessel would be filled with mercury vapor, the pressure of it depending on the temperature of the mercury. Mercury vapor rectifiers are therefore simply well-evacuated vacuum rectifiers with some mercury present within them. The mercury vapor in these devices easily becomes ionized and greatly assists the current flow. It permits wider separation of the electrodes for the same current requirement and therefore greatly decreases the possibility of flash-back.

Practical Applications

The mercury vapor rectifier becomes, therefore, a most useful device, because it permits comparatively large current flow at relatively high potentials. So much for the theory of operation of mercury vapor rectifiers. Let us now consider their practical application.

The modern mercury vapor rectifier employs a highly emissive filament of the oxide-coated variety and an anode of suitable material, enclosed within a vessel containing a small quantity of mercury which has been thoroughly degassified before insertion. The external resistance of these devices is very low, so that a minimum amount of energy in the form of heat is dissipated within the tube. This is another one of the tremendous advantages of mercury vapor rectifiers. So little energy is dissipated in the form of heat that the anode area can be made relatively small and the device as a whole will operate at a low temperature, as compared with vacuum rectifiers of even one-twentieth of their power-handling capabilities.

First thought might indicate that the mercury vapor rectifier should be not at all exacting in manufacturing requirements, but this is far from the truth. Even when operated at relatively low voltages, tubes deficient in many respects may give satisfactory initial performance. The attainment of optimum efficiency in operation and a reasonable life imposes the strictest requirements on the manufacturer of such tubes. It may appear, for instance, that the emissivity of the filament is not of prime importance in this type of tube where actual current is made up primarily of electrons liberated by ionization, but it must be recognized that complete space-charge neutralization can be obtained only where the normal free emission of electrons at the filament is equal to or greater than the electrons impinging on the anode. On the failure to satisfy this condition, additional current can be forced only by increased voltage-drop across the tube, with resultant increase of the acceleration and velocity of the ions, leading to destructive bombardment of the filament and further loss in emissivity—to the ultimate rapid failure of the tube.

So that as a first requirement, even in these tubes, the filament must be processed to sufficient emissivity.

A further requirement with regard to the filament even more exacting than in conventional vacuum tube practice, is that the filament must have not only high emission but must be uniformly emissive throughout its entire area, without spots of high emissivity due either to differences in temperature or coating activity. In the presence of the mercury ions, spots of high activity with a concentration of electron space charge attract a concentration also of ionic bombardment, with further increases in activity for such spots, the eventual concentration of the entire ion bombardment on such spots, and the destruction of the filament.

Again, the process of degassing and evacuation of the tube prior to the introduction of the mercury, must be as thorough as in high-vacuum tube practice, because the presence of contaminating gases may, by chemical reaction, rapidly impair the emissivity of the filament. The presence of such gases also may: (1) increase the initial pressure within the tube, (2) reduce the amount of mercury that may be vaporized at any temperature and therefore reduce the number of mercury atoms in space with a drop in maximum current that could be handled for a normal voltage, and (3) force the voltage drop in the tube above normal at rated current with the destructive effects of the increased bombardment and increased probability of flash-over on reverse peaks because of the increased operating temperature.

[NOTE: *Any questions relating to vacuum tube construction or operation will gladly be answered by Dr. Bruyning as an appendage to the second of his series of articles which will appear in the next issue.*—Editor.]

PROJECTION ROOM VISITORS

SENTIMENT is growing rapidly among projectionist members of the International Alliance in favor of an organization ruling regarding the exclusion from projection rooms of all persons except those who have specific work to do therein or who are employees of the theatre. The ruling would be aimed directly at peddlers of all sorts who now infest projection rooms throughout the country and who are a source of great annoyance if not actual danger to the projectionist in the proper and safe discharge of his duties.

Tentative plans for the ruling would make it necessary for all persons, except employees of the theatre and those who have specific work to do in the room, to secure permission from the business agent of the local union before requesting admission from the projectionist or theatre manager. No exceptions would be made.

Such a ruling is now in effect in various localities, and projectionists report that it has been a great aid to them in the proper execution of their duties.

MEMBERSHIP DRIVE LAUNCHED BY PROJECTION COUNCIL

More widespread support and additional finances held essential to proper functioning of Council and assumption of work on vitally important problems

IMMEDIATE action looking toward a greatly increased projectionist membership, the resumption of dues and the mapping of plans for concerted action by all committees were voted at the recent mid-Winter meeting of the board of directors of the Projection Advisory Council held at the Edison Hotel in New York City. Attracting a full attendance of directors and extending over two full working days, the board sessions were marked by considerable enthusiasm and optimism among the directors.

Directors and officers of the Council attending the sessions were: President Thad C. Barrows, leader of Boston Local Union 182; Joe Basson, L.U. 306; Charles Eichhorn, L. U. 306; Joseph Engel, president, L. U. 640; James J. Finn, Jesse Hopkins, Publix Theatres; Lester Isaac, Supervisor of Projection and Sound, Loew Theatres, Inc., and his assistant, M. D. O'Brien; P. A. McGuire, Harry Rubin, Director of Projection, Publix Theatres, and H. Stein, counsel for the P.A.C.

Statement by Barrows

A statement issued by President Barrows at the conclusion of the meeting is indicative of the consensus of opinion among the directors relative to the matters discussed. Said Barrows:

"The time has come for a cessation of dilly-dallying by projectionists relative to matters which vitally affect their welfare both in and outside the projection room. The Council board of directors, among whom are some of the outstanding men in the craft, are in agreement that if projectionists ever are to be accorded recognition in this industry, they must make a positive bid for that recognition now. It is disgraceful how little cooperation exists among projectionists.

"One has only to review the events of the past year to know that projectionists are rapidly approaching the crossroads—one road leading toward a better craft enjoying better conditions, and the other road leading toward the extinction of the craft. There is no use mincing words: either projectionists through their own efforts will strive for and gain recognition or they must expect no more consideration than a mere mechanic or, bluntly expressed, a truck driver.

"For three years now the Council has functioned without the active support of a great majority of projectionists. It has done splendid work under the circumstances. Requests for assistance in many things have been received, and never has any local union or individual requiring support for a worthy cause been denied—even though they did not contribute to the support of the Council. All this is behind us today. If the Council is to survive, if it is to become a potent factor in helping to maintain the prestige and conditions won by the craft, it must have help—moral and financial aid, and particularly the latter.

Organized Support Needed

"A mere handful of men have done the Council work to date. This will not continue. If projectionists desire the aid of the Council, they must help it along. There is no question but that the Council has proved its value to the craft, in particular to the organized craft: the record proves this to be so. But its future helpfulness will depend upon the men in the field. Will they support the Council, or won't they? This is the important question; and no amount of words can hide the fact that without support and without money the Council cannot function any longer.

Alliance Endorsement

"A committee of directors conferred with President Elliott of the International Alliance today, and the work of the Council has his unqualified endorsement, as well as that of other I.A. officers. Naturally, this endorsement was not forthcoming until President Elliott had thoroughly investigated the workings of the Council and had satisfied himself that the organization merited his support. I can say that the General Office of the Alliance is 100 per cent in back of the Council. Is it necessary to say more than this in order to impress Alliance members generally with the importance of the work that is being done and can be done by the Council?

"From now on there will be renewed activity by the Council—or there will be no Council at all. In a few days there will go out from Council headquarters a general appeal to every I. A. unit in this country and in Canada. This appeal will be couched in unmistakable language and will strip the question of all those superficialities which heretofore have served to befog the matter. It will be a honest statement of purpose, and it should have the honest consideration of every local union. It is to be doubted that the program to be outlined in this letter—a program which has the full support of both the Alliance and those distinguished members of our Board previously mentioned—will fail to produce results.

"We ask the serious consideration of

(*Continued on page* 29)

THE GENESIS OF LABOR UNIONS

LABOR unions of today have their roots in the craftsmen guilds which flourished throughout Europe in the 18th and 19th centuries and a number of which still exist. While the guild interested itself in wages and hours of work its primary purpose for being was to raise the general status of the profession by making its members better artisians. In fact, it was only because the members of guilds were better artisians that guilds were able to function and survive through the years.

Present-day labor unions, the offspring of guilds, follow the trail blazed by their predecessors, but it is obvious that most unions today devote a major part of their energies to the safeguarding of working conditions and wages, to the almost total neglect of better craftsmanship. That which the guild found indispensible to its security—better craftsmanship—today is entirely overlooked by labor unions, a majority of which seem bent on maintaining their position merelv because they *are* unions.

The underlying principle of modern labor unions is better craftsmanship, and it is not inconceivable that were the members of a given union indisputedly the better craftsmen, there would be little need for intense concentration upon wages and hours of work and small necessity for constant intensive effort to safeguard the advantages gained.

FILM EDITING: ITS EFFECT UPON REPRODUCTION

Maurice Pivar

SUPERVISING FILM EDITOR, UNIVERSAL PICTURES CORP. STUDIOS

Film editing is one of the more important processes which exert a strong influence upon reproduction quality. The accompanying article originally was a contribution to the Technical Section of the Academy of Motion Picture Arts & Sciences, and its appearance herein compliments the view that the progressive projectionist should be thoroughly familiar with all processes which go to make up the complete whole—the projected picture.—EDITOR.

PERHAPS the least heralded of all occupations in the motion picture industry is that of the film editor, commonly known as the "cutter." Unlike most of the technical branches of the business, film editing does not follow any set routine but each picture and even each sequence in a picture presents a different problem to the editor. This is especially true today when situations are tied up and involved with the sound element.

The film editor must know not only how to "cut" and assemble a picture, but he must apply intelligence and ingenuity to his work. He must know not only the routine of editing, but he must thoroughly understand and know screen values—dramatic, comic, and photographic—and take full advantage of the film he has in hand so that it will appear to the audience to the best advantage. A cutter devoid of the ability to feel dramatic and comic impulse would be of little assistance to the director even though he might be fully versed in the mechanics of his work.

Those of us who are familiar with productions, are aware that the average feature picture involves anywhere from 30,000 to sometimes 300,000 feet of film, and it requires efficiency and system for an editor to be able to place his hands on any particular scene at any time, without having to wade through thousands and thousands of feet of film.

Handling Excess Film

The systems used for keeping track of this excess film vary in the different studios. We at Universal, through the cooperation of our laboratory and the production department, have simplified this phase of cutting to a great extent. After each day's work on the set, the script girl sends to the cutter a copy of her record of the day's work. This record states clearly the number, the length and the dialog of each scene. This is kept on file from day to day by the cutter. Time and again during the course of editing a picture, a director will prefer a scene changed from one angle to another, and sometimes there is a question as to whether such a scene may have been shot and to avoid wading through the film to verify it, the cutter instead refers to the script girl's notes.

In addition to the script girl's record, a laboratory record is also kept by each cutter. This record is sent through with the film, commonly termed "dailies," which is printed up each day by the laboratory. The edge numbers and scene numbers of each scene printed are marked on the record. Quite often during the editing of a picture a scene is either damaged or more often cut up by the changing of cuts to the extent that a reprint is necessary for practical handling. The use of the laboratory records and the script girl's daily record facilitates the ordering of reprints and the checking of various scenes in the picture.

The routine involved in the preliminaries of editing a picture vary somewhat in the different studios. The majority, however, favor the use of separate sound track and separate action during the process of editing. There are several studios, however, which use movietone prints or, in orther words, prints which have the sound already printed on to the action. This method may be more economical from a standpoint of saving of film, but the writer is in sympathy with the use of separate sound track, for the reason that it offers a greater latitude in the editing of a picture.

Synchronization the First Step

The first step in connection with editing is, as a rule, to synchronize the sound track with the action. This is accomplished by the use of a specific mark or punch at the beginning of each scene. This punch or mark is made on both the action and the respective sound track and it is necessary, therefore, to see that both punch marks start at the same point.

To simplify the handling of separate sound track and separate action, the use of numbers on the edge of the film, spaced one foot apart, is necessary. These numbers are made in duplicate and the same number that appears on the edge of the sound track film also appears on the edge of the action film, both numbers being in the same relative position from the start mark.

With the "dailies" synchronized and properly numbered, they are then shown to the director or any other executives interested in the production. Where there are more than two takes to a particular scene, the director, as a rule, selects the one he prefers and this is the one which is set aside for use in the picture, the others being kept on file.

The efficient editor as a rule starts to edit his picture with the completion of the first sequence. All of the film of this sequence when completed is assembled in continuity order. This gives the editor an opportunity to familiarize himself thoroughly with the film on hand and enables him to visualize the cutting possibilities of the sequence. The editor's objective, then, is to cut this sequence to the best advantage, utilizing such angles as he feels will present the sequence in the most effective manner on the screen.

The 'First' or 'Rough' Cut

This procedure is continued as the director shoots his picture, so that within a few days after the director has completed his picture, it is practically ready for him to see in what is termed the "first," or "rough," cut. Most directors are thoroughly familiar with cutting and at times are of great help to both the picture and the editor. The director, having made the picture, naturally may have his own ideas with regard to the way certain angles should be used to portray certain scenes. In shooting the sequence, he may have been striving for a certain dramatic or comic value in the situation. Then, oftentimes, the editor may cut it from his own point of view. This, naturally, brings about discussion and, with an intelligent editor, the director at times may find that the editor has already gotten the most out of the situation with the film in hand.

The best results are generally obtained when both the director and the editor work in close harmony and are open-minded to suggestions.

The picture in first cut naturally runs considerably over the general releasing length, and before any final eliminations are made, the picture is presented to the public for its reactions, all further cuts or eliminations being determined by

(*Continued on page* 34)

S. M. P. E. SPRING MEETING IN NEW YORK, APRIL 24-28

The regular semi-annual meeting of the Society of Motion Picture Engineers will be held at the Pennsylvania Hotel in New York City April 24-28, according to an announcement by the Board of Governors of the Society. A banquet is planned for Wednesday night during the meeting. The meeting will cover five full days, due to the abbreviated convention held last Fall and the mass of valuable material that has accumulated as a result. W. C. Kunzmann is chairman of the Convention Committee, and will be assisted by Herbert E. Griffin, local committee chairman.

The Papers Committee has begun the preparation of the program and promises a meeting of unusual interest. The number of papers will be limited to what can be accommodated in the alloted time, without haste or crowding. The exhibition of newly developed equipment is expected to be of particular interest and magnitude, a year having elapsed since the last exhibition.

CURVES: THEIR STRUCTURE AND HOW TO READ THEM

Aaron Nadell

III

FIGURE 1 is a chart, not a curve. It is in itself highly informative and its information will be of help in interpreting some of the curves most commonly used in connection with the operation of sound systems. It is a chart of the frequencies of audible sound, and before studying it the nature and meaning of frequency should be very clearly understood.

Comparison with the waves of the ocean, which can be seen, is perhaps the clearest approach to the nature and action of waves of sound, which cannot be seen.

If one wave strikes the beach every 15 seconds, there will be four waves in a minute. The frequency of these waves, then, will be four per minute. If the waves are much smaller, as in the case of ripples set up by a passing motor boat, there may be forty of them a minute. Each wave, whether large or small, will carry with it numerous smaller ripples that ride upon its surface. These are called—in connection with sound waves—*harmonics*, or overtones. The harmonics are always several times more numerous than the larger, or *fundamental*, waves that carry them.

Nature of Sound Waves

Waves of sound are waves of compressed air, which are naturally invisible because air itself is invisible; they travel at a rate of, roughly, 1,000 feet per second, regardless of whether they are large or small, strong (high compression of air), or weak (low compression). If they are small, a great many of them enter the ear in the course of one second; if they are long waves only a few enter the ear in each second. But in almost every case, the waves of sound, whether small or large, carry carry with them still smaller ripples, or harmonics, of which there are a fairly large number in every second.

The difference between one note of music and another is only a difference of frequency, of the number of waves of compressed air that leave the source of sound, or that arrive at the listener's ear, in one second of time.

Disregarding for the moment every other part of Figure 1 except the center, which is a piano keyboard, it will be seen that the figures printed immediately below the piano keys give the frequency, in cycles or waves per second, for most of the notes. The higher notes, as previously stated, have the higher frequencies; shorter waves and therefore more of them per second.

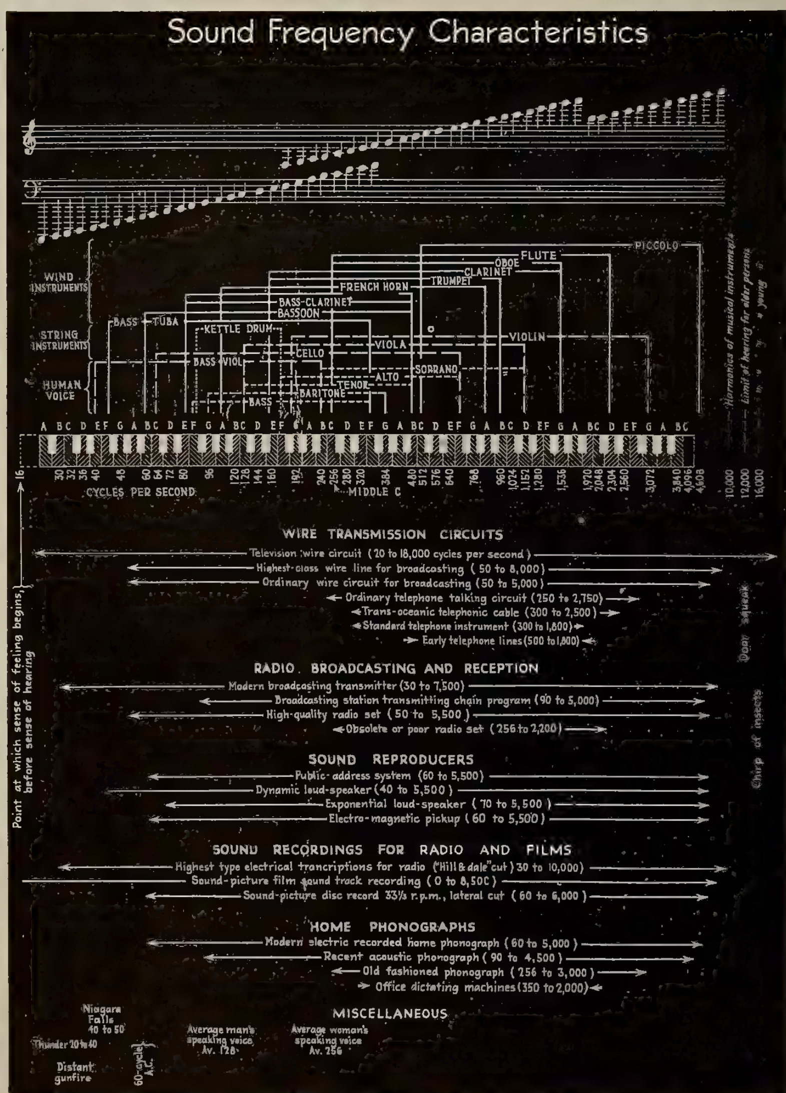
The spacing of these figures will be seen to be irregular. The distance from 32 to 64 is exactly the same as the distance from 1,024 to 2,048. This is the way the human ear hears sound; 64 is twice 32, and 2,048 is twice 1,024. Following the octaves of the keyboard up the scale, it will be seen that the ear appreciates the distance from one frequency to its double as an octave. The lowest C is 32, the next is 64, the next is 128, the next is 256 cycles, and so on—double each time. To the ear, the distance between 1,024 and 2,048 is exactly the same as the distance between 16 and 32.

Instrument Frequency Range

At the top of the chart is the musical scale, showing the notation for each note of the piano, and therefore for each frequency.

Between the scale and the piano keyboard are a number of brackets showing the frequency range of each instru-

FIGURE 1



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ment. The piccolo, for example, is shown at the top and to the right of this group of brackets. Its range, in frequencies, is from 512 to 4,608 cycles per second. That is, sound from the piccolo will produce anywhere from 512 to 4,608 waves of compressed air in each second. The violin is shown to have a frequency range of from 192 to 3,072 cycles per second. A number of other instruments are listed, of which the bass viol reaches the lowest note, 40 cycles, and the piccolo, as said, the highest at 4,608.

In this same group of brackets, between the musical scale and the piano keyboard, is a group of five brackets—the five lowest—showing the range of the human singing voice. Bass, baritone, tenor, alto and soprano are shown, the human bass reaching as low as 80 cycles, and the soprano as high as 1,152.

Importance of Harmonics

But this is not all there is to sound. The little ripples, or *harmonics*, are of the greater importance. If they did not exist, all notes of the same frequency would sound alike no matter what instrument played them or what voice sang them. Excepting the bass viol, the kettledrum and the piccolo, every instrument and voice shown on this chart can produce "middle C"—256 cycles per second. Yet this note does not sound the same when sung by a bass and by a soprano, played by the violin and by the piano. In each case it will carry with it a different pattern of those small ripples called *harmonics*, which distinguish one instrument or voice from another. To the right of the piano keyboard there is the number 10,000, with the notation, "harmonics of musical instruments," indicating that some of the smaller ripples are so small that with sound traveling at 1,000 feet per second, 10,000 of them can crowd into one second; obviously then, some of these very small waves that follow so rapidly upon each other are little more than one inch long. At the extreme left of the keyboard is the number 16, with the notation, "Point at which sense of feeling begins before sense of hearing";—this refers to the lowest notes of a large organ which, as everyone knows, seem to be *felt* quite as much as they are heard. These waves, of which only 16 arrive in one second, are more than 60 feet in length.

Auditory Limits

At the far left of the keyboard are the figures 12.000 and 16,000, the upper limits of hearing for older and for young persons, respectively. There are sound vibrations of higher frequency than can be sounded on instruments. Sound vibrations of at least 100,000 cycles can be created artificially, and have been shown to be deadly to insects and to small animals like mice. But these figures—12,000 and 16,000—mark the shortest waves of sound that human ears can hear. They lie above the limits of any ordinary musical instrument, above even the more important harmonics. The chirping of some insects lies in this region of many thousands of sound waves in one second.

Below the keyboard are five groups of arrows, properly labelled, showing the frequency range of theatre sound systems, of radios, phonographs, telephone instruments and telephone circuits, etc.

The fourth of these groups from the top is perhaps of greatest interest to the projectionist. It shows that a "hill-and-dale" cut record is capable of recording from 30 to 10,000 waves of sound per second, while the lateral-cut disc commonly used in theatres of today is restricted to a range of from 60 to 6,000. At that, the theatre-type record is far superior to that of an old-fashioned phonograph (the bottom group), which was limited to from 256 to 3,000 cycles.

Again, the fourth of these groups from the top shows that the film sound track has no lower limit, being capable of recording one wave a second or one an hour—if the loud-speakers (third group from the top) could reproduce them or the human ear hear them—and has an upper limit of 8,500 waves of compressed air per second.

The projectionist may be interested in studying some of the other limits shown in these five groups of arrows.

Underneath them, again, it is indicated that the sound of Niagara Falls has a frequency of from 40 to 50 waves per second, thunder and distant gun fire of from 20 to 40. The average male speaking tone is shown as 128 cycles, the average woman's as one octave higher, or 256 cycles. These figures, of course, refer to the TONE of the voice. Every sound spoken has its own frequency: 's' and 'f' sounds in the deepest male voice do not have a frequency below 3,000 cycles, and their harmonics may run up to 8,000. It is the melody behind the voice, so to speak, that is pitched at the low figures given at the bottom of this chart.

At the extreme right of the chart, beside the first and second group of arrows, the squeak of a door is placed

Thank You!
Our appreciation is extended to all those who in commenting on the present series of articles by Mr. Nadell made suggestions which will prove valuable in outlining a new series by the same writer.—*Editor*.

NEW DUOVAC 205-D TUBE

THE marked improvement in sound quality caused by the introduction of the Duovac thoriated tungsten filament -242 with a molybdenum plate, which by this time has entirely superseded the old type 211-E oxide-coated tube with nickel plate, prompted an investigation by the Engineering Dept. of Duovac Radio Tube Corp. into the possibility of incorporating the same improvements into the oxide-coated filament type 205-D.

Experiments on the design of such a tube were begun several months after the introduction of the 242, and although various obstacles had to be overcome to make this type tube conform to the characteristics of the oxide-coated filament 205-D, the developmental and experimental work has been brought to a satisfactory conclusion and the new tube placed on a production basis.

The advantages of this new Duovac 205-D tube are as follows:

1. It is not susceptible to breakdown when temporarily overloaded.

2. Due to the fact that there is no coating on the thoriated tungsten filament, the heating period is almost instantaneous and uniform.

3. The thoriated tungsten filament can stand momentary overloads as high as 100 per cent.

4. Thoriated tungsten type tubes are, as a rule, far more uniform in general characteristics and therefore practically eliminate the deliberate selection of tubes.

5. The use of molybdenum plate will permit a considerable overloading of the tube without causing permanent damage. In other words, molybdenum plate permits degassification to a greater extent than does a nickel plate, and therefore does not liberate gas when overloaded. The sandblasted rough surface of molybdenum plates allow cooler operation at all times.

General Rating

New Duovac 205-D Tube

Filament Current	1.6	1.6	1.6	amps.
Filament Voltage	4.5	4.5	4.5	volts
Plate Voltage	250	300	350	volts
Negative Grid Voltage	15	20	25	volts
Plate Current	22	25	28	mills
Mutual Conductance	1,650	1,700	1.700	micromhos
Amplification Constant	7	7	7	

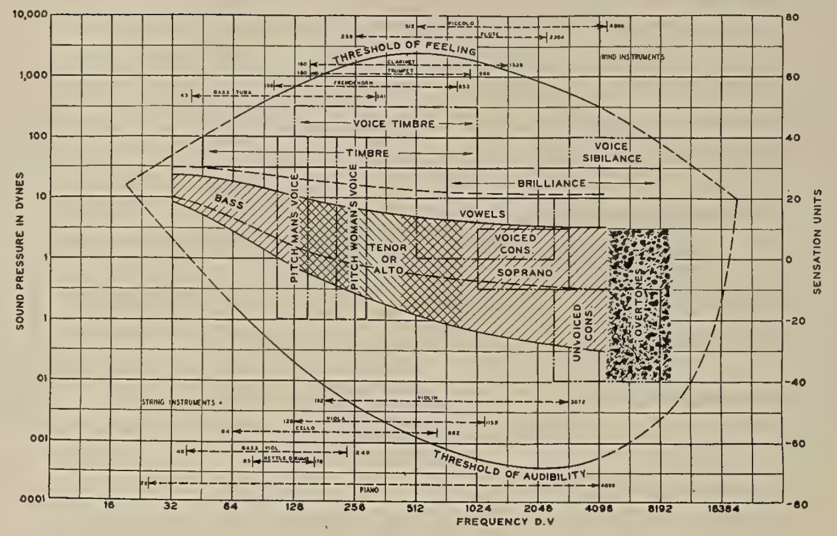


Figure 2

below the figures for 12,000, and the chirp of insects below the figures for 15,000 cycles.

THE information conveyed in Figure 2 is very nearly the same as that in Figure 1, with additional facts added. Figure 2 is drawn against the usual graph background—with some complications, because of the enormous amount of information it conveys. Taking that information bit by bit, however, it will easily be seen that at least half of it is the same as that which has already been pictured in Figure 1. In Figure 2 the place of the keyboard is taken by the row of numbers along the bottom of the rectangle—the same arrangement of numbers, it will be noticed—16, 32, 64, 128, etc.*

These numbers refer to the vertical lines of the graph, which represent frequency. Disregarding the horizontal lines, temporarily, and considering only the frequency lines, it will be seen that at the very bottom of Figure 2 there is a long line of dashes, with an arrowhead at each end, which is labelled piano. This line shows the frequency range of the piano, and takes the place of the keyboard in Figure 1. Immediately above this are a number of other dash-lines, similarly tipped with arrowheads, representing a number of string instruments. Another series of dash-lines, toward the top of the chart, show the frequency ranges of several wind instruments.

Directly below the dash-lines indicating wind instruments are solid lines showing that the *timbre*, or distinguishing tone of human voices, extends from 124 to 1,024 cycles; that of instruments from 1,024 to 48 cycles. Close below these two rectangles with lettering running upward center the pitch, or distinctive tone, of the male voice at 128 cycles, of the female voice at 256 cycles, exactly as did Figure 1.

A bit to the right of, and below, the word "timbre" another arrow-line and the word "Brilliance" indicate that the clarity and distinctness, the sparkle and attractiveness of sounds lie in those waves that run from 768 to 8,192 per second—that is, in the overtones or harmonics.

Dynes—Sensation Units

It is now time to consider the horizontal lines of this graph. The notation at the left of the rectangle shows that those lines represent *dynes*—a *dyne* is a unit of physical power, similar to, but much smaller than, the horse-power. But the notation at the right of the rectangle reveals that these same lines also stand for "sensation units"—a method of measuring the reaction of the human ear to sound. The dyne, then, evidently is translatable into sensation units; according to this graph, 10 dynes equal 20 sensation units—1/10 of a dyne, minus 20 sensation units. So much for the horizontal lines.

Conspicuous on this chart is a closed area, bounded above by a curved line marked, "*Threshold of Feeling*" and below by another curved line labelled, "*Threshold of Audibility*". This enclosed area indicates all the sound—all the air waves—that human ears can hear. From right to left it extends from almost 16 to above 16,000 waves per second. But the horizontal lines indicate that volume necessary to hear sound varies with the frequency. Sound waves at 2,048 per second can be heard if their volume is as weak as .004 dynes of pressure, or almost —70 sensation units. Sound waves of 20 cycles per second require more than 10 dynes of air pressure to fall within the area of audibility.

The upper curved line represents the upper limit of loudness that the average ear can endure. It will be seen that a sound of 512 cycles can be louder than any other without crossing the threshold that divides hearing from feeling, or from pain.

The center of the chart is occupied by a shaded area, which represents the range, in frequency and volume, of the human voice. At the right of this area is a rectangle more heavily shaded, indicating the range in frequency and in volume of the overtones, or harmonics, of the human voice. In and near this shaded area are several rectangles, builded out of dot-and-dash lines, that deserve explanation.

One of these is labelled—some distance above the overtones—"Voice Sibilance," and indicates the position of the "s" and "f", the "sh" and "ch" sounds of human speech. Directly below it is the area of "Unvoiced Consonants"—the "d" and "t" sounds. Above and to the left of this is the area of the voiced consonants—"n" and "m", for example; and above and to the right of that, again, the area of the vowels.

It will be seen that Figure 2, which is a chart, and a graph, and half a dozen curves, all in one, carries the same information as does Figure 1, and a

* Below these is printed the legend, "Frequency D.V." The "D.V." represents "double vibration" or cycle.

H. E. Griffin Appointed S. M. P. E. Governor

H. E. Griffin

HERBERT E. GRIFFIN, of the International Projector Corp., has been appointed a member of the Board of Governors of the Society of Motion Picture Engineers to fill a vacancy created by the resignation of L. C. Porter, resulting from a gradual disassociation from the motion picture industry due to changes in the nature of his work with G. E. Mr. Porter has been a member of the Society since 1917 and served as President during 1922, '23 and in '29.

Mr. Griffin has long been one of the most active members of the Society and has rendered valuable services in a number of capacities. His motion picture experience extends over a period of twenty-five years, almost all of which time was spent in the projection field. As General Sales Manager of International Projector Corp., Mr. Griffin has witnessed the development of the projector from the old hand-cranked "coffee grinder" to the marvelous mechanism that is the projector of today. A host of friends within and without the projection field will welcome Mr. Griffin's advancement in the Society.

For twenty-five years Mr. Griffin has been a member of organized labor and is today a member of L.U. 306, I.A.

great deal more. It may be instructive to compare these two figures carefully and note the superior advantages of the second as a means of conveying facts. Some of the usefulness and value of curves and charts will become still clearer if the reader reflects upon the number of printed pages that would be required to impart all the information contained in Figure 2, and considers how minutely those pages would have to be indexed if that information were to be rendered so readily accessible.

(To be continued)

Edward Bausch Honored by Genesee Society

Edward Bausch, president of Bausch & Lomb

EDWARD BAUSCH, President of the Bausch & Lomb Optical Co., was the guest of honor this year at the annual dinner of the Society of the Genesee, an organization of men and women who have lived in the Genesee Valley of New York State and who meet each year to honor an outstanding neighbor and renew old friendships. The annual dinners have been held in New York for many years and many notable men have been honored. This year the meeting was held on Monday evening, January 23, at the Commodore Hotel, N. Y. City.

Edward Bausch is one of America's early microscope builders, starting when there were only eighteen microscopes in the entire country. He designed instruments and devised methods of producing them in sufficient quantities so that they could be sold at a low price. Microscopes cost thousands of dollars in the early days because they were made by hand. Edward Bausch developed and produced them to sell between one and equal to any unit at that time.

Edward Bausch has been a leader in the invention of optical equipment and the development of mechanical means for producing it at a reasonable cost. He was born only a stone's throw from the Genesee River and has spent his long life building the enormous Bausch & Lomb Optical Company plant upon its banks. While his neighbors honor him for what he has done in the community as a man, the nation remembers him for his scientific achievements during this 79th year of a long and useful life.

Rear Projection Benefits Through Greatly Improved Technic

REAR projection is not new; it has been used for fifteen years in Germany, France, and England. In this country we are all familiar with the small projectors used in public places for advertising, demonstration, and stock quotations. Application to the theatre was delayed by two difficulties: one, the lack of a suitable translucent material, and the other, of an efficient distortionless wide-angle lens. Within the past two years several small theatres have opened in New York to show newsreels and short subjects on a rear projection screen.

There are several possible materials for use as rear projection screens. The more common are dental rubber, treated silk, ground glass, celluloid, and a gelatin composition. The last is one which is being used on a large scale. Glass screens have a satisfactory transmission characteristic, but the large sizes are heavy and difficult to protect. Celluloid screens would be satisfactory if it were not for their fire hazard. All rear projection screens have the disadvantage that large uniform areas of material must be used. They differ from front projection screens in this respect, for the latter are sewed together from strips of standard width. The process of manufacture of the gelatin screen is as follows:

On a heated table is poured a hot gelatin solution, over which is stretched smoothly a fine silk fabric which is pressed into the gelatin. The combination is allowed to cool slowly about twenty-four hours, and is then placed on a rack to dry for seventy-two hours. Care must be taken to keep water from touching the screens, as the composition is soluble in water. The screens may be cleaned with alcohol. They can be furnished in any desired color, but at present a slight bluish tint is standard.

Apparatus and Projection

It may be of interest to point out several facts about the installation of rear apparatus as it is done in these small theatres. Standard apparatus is used, two machines being mounted about 8 feet behind the screen at an angle of 45 degrees with each other and 22½ degrees with the screen normal. Each lens is approximately 7 inches off the screen axis. The width of screen that is possible is determined by its distance from the projection lens. The rule is that 1 foot of width is possible for every foot of separation between the screen and the 1-inch focal length lens that is employed—in this case, 8 feet.

There is a general impression that film as projected over these machines must be reversed. This is not so, as a prism is employed to reverse the image on the screen and to bend the light rays through an angle of 22½ degrees. The prism is mounted immediately ahead of the negative projection lens.

The screen is mounted about 5 inches above the head of an observer in the first row. This makes possible the installation of a horn or baffle loudspeaker beneath and on a line with the screen. It must be pointed out that this position for the speaker is not quite correct for furnishing the proper illusion, which, however, is yet acceptable in the front rows to the ordinary observer. At the rear of the theater, the effect is quite good, in as much as the auditorium is small and sound mixing helps create the correct impression.

One advantage of the rear projection installation may be pointed out. It requires less vertical space and no specially dimensioned auditorium. Hence it is possible to employ as theatres enclosures similar to small stores.

Auditorium Illumination

The light transmission may be varied to meet different requirements. It has already been noted that transmission may be made to favor any particular color. It also may be made to give several different types of distribution. By proper processing, the distribution is made more uniform, and hence satisfactory for viewing at wider angles. It must be expected that there will be an additional loss of contrast as compared with front projection because of the introduction of another translucent surface, which adds to the flare effect.

Since the screen is light-transmitting, the light intensity in the auditorium can be considerably higher than in the ordinary theatre during a performance. It has been stated that the auditorium is illuminated to about 30 per cent of average theatre full lighting. Nevertheless, it is necessary to take precaution to keep light from falling on the screen, in as much as there is some slight reflection from the surfaces. High auditorium illumination means that confusion in seating is practically eliminated. For type of theatres where patrons are continually passing in and out, it is very desirable to have considerable light.

It must be remembered, however, that a partially lighted auditorium tends to prevent patrons from "living" through a feature presentation, since it makes one too conscious of his immediate surroundings. In a theatre showing newsreels and short subjects, this is not objectionable.

EFFECT VAST IMPROVEMENT IN DISC REPRODUCTION

General Acceptance of Sound-on-Film for Economic Reasons Obscures Recent Splendid Technical Advances Made With Disc Process

H. C. Harrison
MEMBER OF TECHNICAL STAFF, BELL TELEPHONE LABORATORIES

DURING the last few years the complete subject of sound recording and reproducing has been reinvestigated. Methods have been developed by which it is possible to reproduce with markedly improved quality. This has required both that a wider band of frequencies be recorded, and that more of the extraneous frequencies, either in the form of surface noise or of distortion, be excluded. Such a twofold gain was made possible only by a coordinated development along three lines: the design of apparatus that would record and reproduce a wider band of frequencies, the production of a record with considerably less surface noise, and the securing of decreased distortion arising from improper tracking of the reproducing needle. These improvements were obtained by an improved design of recorder and reproducer, by a new method of processing the records, and by a different manner of cutting the groove.

Errors in Cutting Method

In the studies of sound recording and reproducing that followed the orthophonic phonograph and the sound picture, careful measurements soon showed that a certain amount of distortion introduced in the reproduction was to a large extent inherent in the method of cutting then employed. With that method, known as lateral cut, the depth of the cut remains constant. The cutting stylus is moved radially in correspondence with the actuating sound to chisel a wave groove on the rotating disk, as shown in Figure 1. This groove is of the same width along the radius of the disk at all points. Since it is a wavy one, however, winding toward and away from the center of the record with the variations of sound pressure, the distance across the groove—perpendicular to its sides—is not constant. It is widest at top and bottom of the waves and narrowest on the slopes as shown in Figure 2.

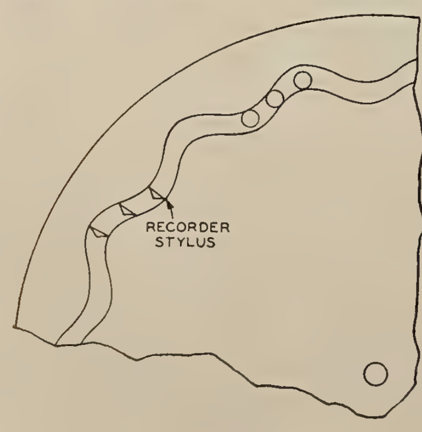


FIGURE 1

In the lateral system of recording the cutting stylus is moved radially in response to the sound to cut a wavy groove on the disc

The reproducing needle, on the other hand, is round, and its diameter cannot be greater than the distance across the groove at its point of greatest steepness. Along these sloping sections of the groove the needle is guided by both sides and follows the actual form of the groove with fair precision. Along the tops and bottoms of the sweeps of the groove, however, it is in contact with only one side of the groove at a time, and may skid from side to side, thus introducing distorting frequencies.

Vertical Cutting

Another method of recording on wax is known as vertical cutting. With this method the stylus is moved up and down and thus leaves a groove of which the depth varies according to the sound. It gives a series of hills and valleys along the groove, and the method, for this reason, is often referred to as "hill and dale." It is illustrated in Figure 3. In reproducing from this type of record the needle is held to the bottom of the groove by an unbalanced portion of the weight of the reproducer head. Although the actual pressure on the disk is small, it is sufficient—in conjunction with a light spring by which the needle is fastened to the reproducing head—to force the light stylus to follow the exact undulations at all times. There is no skipping, so the distorting frequencies that sometimes occur with side-cut records are absent with the vertical.

Although vertical recording has been employed by others before, the greater part of the development of the past has been in connection with side-cut records. Because of the inherent reduction in distortion that analysis and preliminary studies indicated could be obtained with vertically cut records, however, vertical cutting was taken by the Bell Laboratories as the basis of the new method. It has another advantage over the side-cut record in making possible a longer playing time. With side-cut records the radial distance between adjacent grooves must be great enough to allow the maximum displacement of both grooves from mean position—corresponding to the greatest volume of sound—without danger of cutting through from groove to groove. The actual annular space allowed for a groove must be the width of the cutting stylus, plus twice the maximum displacement of the groove, plus a small remainder to insure that adjacent grooves remain separate.

With vertically cut records, on the other hand, very little allowance need be made in the spacing of adjacent grooves for the displacement of the groove. Due to the tapered sides of the cutting stylus there is a widening of the groove as the depth increases, but it is of minor importance compared to the full displacement of the groove that must be allowed for with side-cut records. Because of this fact it is possible to cut vertical records with a pitch of from 150 to 200 grooves per inch—thus giving standard twelve-inch records that will play from 15 to 20 minutes on one side, or ten-inch records that will fit in the cover of a 1,000-foot film can and play for from ten to twelve minutes. The difference between the two types of record is shown in Figure 4.

Faults to Be Overcome

Although the adoption of the vertical method laid the foundation for better sound reproduction, the major development work still was to be done. Perfection in recording requires not only that distortion—in the form of false frequencies or sounds—be eliminated but that all the frequency components in the sound be present in their correct volume ratios. Although the ear recognizes as sound all periodic pressure variations in air occurring at frequencies from about 30 to some 16,000 cycles per second, all sections of this range are not equally important. Recent investigations have shown that the quality of orchestral music improves materially up to about 8,000 cycles but that the reproduction of only a few pieces, such as the percussion instruments, is noticeably bettered by the inclusion of frequencies above 10,000 cycles. The ear also recognizes as sound, vibrations over a pressure range of about a million to one, or 120 db. The best

FIGURE 2

The width of the groove measured radially is constant since it is equal to that of the cutting stylus. The width of the groove perpendicular to the sides, however, is not constant because of its undulating character

phonograph and sound picture practice included comparatively small amounts of frequencies above 5,000 cycles for a range of loudness corresponding to a pressure range of but 50 db.

Vertical cutting makes it much easier to increase the loudness range because, as already pointed out, an increased depth of cut does not necessitate a corresponding increase in the spacing of the cutting groove as it does with the side-cut record. Moreover, a small amount of overlapping of the grooves is of no great matter with the vertical system since the reproducing needle follows the bottom of the groove and is not affected by the sides, provided they are smooth. The adoption of vertical cutting thus made it possible not only to eliminate the distortion arising from improper tracking but to increase the loudness range as well. To include a wider band of frequencies, however, an improved recorder and reproducer were required.

This widening of both frequency band and loudness brought in still further difficulties. In the ordinary record there is a certain amount of surface noise, caused by lack of smoothness of the record, which is ordinarily made unobjectionable by recording at a displacement that is high compared with the irregularities in the surface. To record at a wider range of loudness while maintaining the same magnitude of surface irregularities, would require too deep a cut. If, on the other hand, this ratio were decreased without decreasing the surface irregularities, the result would be very noisy records, and the good effect of the inclusion of the higher frequencies would be largely lost because of masking by the surface noise. It seemed necessary, therefore, besides a new recorder and reproducer, to develop a smoother record surface.

Here, also, certain methods which had been tried and rejected by others in the past seemed to offer great possibilities if a technic of manufacture could be provided which would avoid the earlier causes of failure. A large amount of work has been required over a number of years. The several lines of development had to be coordinated and carried on simultaneously. The result, however, has been eminently successful.

New Method a Great Advance

A method is now available which results in the ability to record and to reproduce frequencies up to 8,000 cycles per second—about 3,000 cycles higher than has been commercial sound picture practice. It results also in so improved a surface that the usually prevalent needle-scratch in the best recordings is

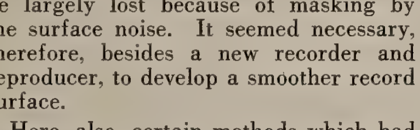
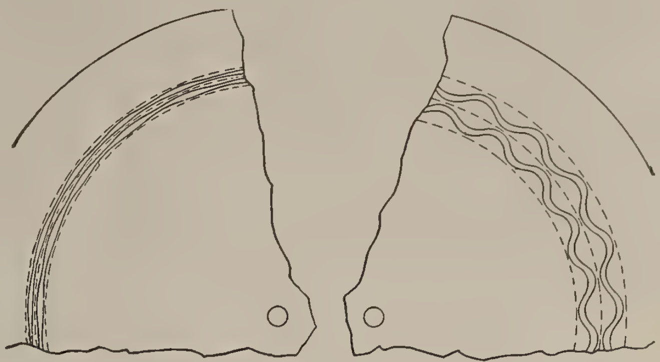


FIGURE 4

A schematic indication, not to scale, of the difference between lateral and vertical records

FIGURE 3

The waves cut by the new method are in a vertical rather than a horizontal plane



nearly inaudible: a necessary requirement if full advantage is to be taken of the presence of the higher frequencies. The overall result is a much greater naturalness: voices and instruments are more readily identified and the finer shades of tone are better brought out. The ultimate objective of reproduction—complete illusion of the actual presence of the orchestra or voice—is nearly attained.

Possible Applications

Not the least of the advantages of the new system is that the method of processing the records is as simple and inexpensive as the present method. The various steps require neither highly-skilled operators nor delicately controlled processes. The record is cut on a thin layer of wax flowed onto a metal disk, and after being cut is given a thin plating of gold by a method called "sputtering". This surface is then heavily plated with copper to strengthen it, and records are made, by a hot pressing process, of a very smooth and practically unbreakable material. The reproducing stylus is not a replacable steel needle but a permanent sapphire. Because of the light pressure of the reproducing stylus, records will last for several thousands playing with no noticeable deterioration.

Bell Laboratories, by its recent developments, has thus made available a greatly improved system of sound reproduction, which should have many commercial uses in the future. In addition to a variety of miscellaneous uses, there is, of course, the possibility of greatly improved sound pictures, but the usefulness of the system is not limited to this field. A new form of phonograph employing the improved records and electrical reproduction seems an attractive possibility since 15- or 20-minute records of music almost indistinguishable from the original would be invaluable. One of the fields of immediate usefulness is that of the production of high-quality records for broadcasting purposes. The frequency range of these records is so much wider than the broadcast bands that the radio listener cannot distinguish between an electrical transcription made with this type of record and an original production.

Whatever use is made of the new system, however, it is now possible because of this development to reproduce music and speech with such fidelity and so free from disturbing scratch that almost perfect naturalness is obtained.

'GRAND HOTEL' VOTED BEST PICTURE IN 1932

In the biggest vote of its kind to date, "Grand Hotel" heads the list of the Ten Best Pictures of 1932 as picked by the country's leading film critics and editors in the eleventh annual poll conducted by *The Film Daily*. The other nine, in the order of votes received, are "The Champ," "Arrowsmith," "Smilin' Through,'" "The Guardsman," "Dr. Jekyll and Mr. Hyde," "Emma," "Bill of Divorcement," "Back Street" and "Scarface."

Five new records were established in the 1932 poll. Total number of critics voting was 368, against the previous high of 340 in 1931. "Grand Hotel's" total of 296 votes was a new record for a single picture, the previous top having been scored in 1931 by "Cimarron" with 273 votes. The lead attained by the first picture in the list over the picture that follows it also was by the biggest margin yet scored by a winner, and for the first time every film in the winning list had a vote of 135 or more, while a picture with 117 votes could not get into the first ten. A new record for number of winners by one company was set by M-G-M, which garnered five out of the ten.

Pictures listed in the poll were those released in the fiscal year to Nov. 1, 1932.

COURT RULING ON NUMBER OF PICKETS USED

Latest ruling relative to the right of a union to picket a theatre came from Vice Chancellor Berry of Newark, N. J. Injunction restraining the projectionist local union there from picketing a theatre was lifted the following day, with accompanying ruling that not more than five men could be used in picketing operations. It had been charged that 50 to 60 men were placed on the house by the union, which asserted that it had never exceeded 25.

Result of Contract Breach

Court held that no proof was available that threats or violence had been used, and wording of placards was okayed. Bad business, it held, was not sufficient reason for theatre breaking its contract, and it was evident that the union trouble had resulted from a breach of a contract which had been lawfully entered into.

Projectionist Servicing Plan

(*Continued from page* 10)

acute among the smaller Locals. This phase of the situation merits immediate attention. Any Local not having a member wholly capable of handling the servicing assignment might follow the lead of San Francisco and take in either an ex-service man or one who is now affiliated with a sound company but who is not unwilling to work with the Local. Complete dependence should not be placed on one man. Once a leader, or organizer, is selected, plans should be laid for instructing several other members along servicing lines, so that once underway the work may not suffer through the inability of one man to bear the load. Servicing should be considered as definite an obligation on the part of the Local as is projection work now.

Reasonable Rate Will Help Drive

There is no question but that Locals can do sound servicing much more cheaply than any other agency. The concentration of all accounts in a comparatively restricted area would mean vastly decreased traveling expenses and consequent reductions in expenses. A Local should be able to offer any theatre complete servicing facilities at a fraction of the cost of present servicing, and this sharp reduction would lend impetus to the spread of servicing work by projectionist organizations. Excessive charges will hardly attract the fancy of the exhibitor; but an offer of quality work at a reasonable cost will quickly bring this work into the hands of projectionists.

Existing servicing contracts have not yet been legally adjudicated, thus the need for caution by projectionist organizations with respect to their solicitation of servicing accounts persists. However, there is nothing to prevent projectionists notifying exhibitors that they are able and willing to assume such work at the proper time. This is very important. An open field exists, of course, with respect to those theatres which own their sound equipments outright.

Immediate action by projectionist organizations looking toward the assumption of sound equipment servicing is urged. A capable man, or men, should be prepared, accounts should be solicited and all members of all organizations should be instructed to closely watch developments. The time for action is now. Think about it not in terms of aggression but of protection.

Two-Men Operation Fought

(*Continued from page* 10)

who was intimately connected with the Kaplan cases knows these statements to be true. More anon about this, with facts and figures, if they can be unearthed.

No projectionist organization need be bulldozed by any exhibitor or banker representative who sweepingly declares that one-man shifts are adequate for the proper operation of a projection room. It might be claimed that many theatres are operating today with only one man on duty, but this in itself proves nothing over and above what is proved by the ability of one man to operate a locomotive over a given distance and for a definite period of time.

International Projectionist now has in preparation a booklet which will present the facts relative to one-man vs. two-men projection shifts. Sufficient data for completing this job is expected to be at hand shortly, following which the work will be put into production. A copy of this booklet will be distributed to every projectionist organization throughout this country and in Canada, in addition to other interested parties. The desire to make this booklet as complete and accurate as possible prompts the suggestion that projectionists everywhere contribute their views relative to this vitally important topic. All contributions will be welcome.

Undue stress has been laid, it appears, on the fire hazard of one-man projection shifts. While this is an important consideration, it is only one of a number of reasons which justify the retention of two-men shifts. Screen results are of the utmost importance, too, and that exhibitor who invites inferior screen results by adhering to one-man projection shifts is as guilty of robbing the patron who pays his admission as though he pushed that patron into an alley and slugged him before emptying his pockets. Projectionists, not firemen, are needed in projection rooms.

Projectionists cannot expect to retain favorable conditions unless they fight for them. One of the ways of fighting for better conditions is to cooperate with those agencies which seek to be of assistance. A start toward this goal may be had by assisting in the preparation of data which should prove helpful in bringing the facts relative to the subject of one-man vs. two-men projection shifts to the notice of all interested parties. One means for attaining this end is cited above. Will you help?

TRANSMIT MUSIC OVER A 'COLD LIGHT' BEAM

MUSIC created by a group of entertainers was successfully flashed high in the air over New York City recently on a beam of "cold light," linking an improvised radio studio atop one of New York's tallest skyscrapers with the headquarters of a nation-wide radio network, a half-mile distant. The test was the first use of a light ray by the Columbia system for a regularly scheduled broadcast picked up as an "out-of-the-studio" presentation. No wires were employed, as in the usual remote pick-up, to link the microphones with the central control room of the network.

Quality Is Unimpaired

The entertainers who played and sang were in the observation tower of a building nearly 1,000 feet above the street. The receiving point for the beam of light was before a window on the sixteenth floor of the Columbia System's building.

Sound experts and witnesses who heard the music over the beam called the quality equal to the standard sought for over wire lines.

The lamp is a "mercury induction" bulb about an inch in diameter and five inches long. Inside the glass is a thimbleful of mercury. When a high-frequency electric current generated by a vacuum tube and circuit excites the mercury it glows with intense brilliancy, but generates very little heat. Thus the bulb has been called a producer of "cold light."

The microphone used by the entertainers caused the light, cradled in a Sperry searchlight projector, to go out as a beam toward the Columbia building and carry the musical vibrations through space. At the receiving end of the link a photo-electric cell placed at the focal point of a large convex lens, gathered the rays from the air and converted the light back into electricity for the network of nearly fifty stations.

Sound experts said it would be possible in clear weather to send programs, without loss in quality, over distances as great as forty to fifty miles. Any one with a light cell amplifier and loud-speaker could take music from such a beam, he said, at all points where the light was visible. Wires would not be necessary, nor radio sets. The mercury lamp works as well in daylight as it does in darkness and is expected to find extensive application for all types of communication over limited distances.

A peculiarity of the sound rays is that no interference is caused by beams criss-crossing. The only precaution is that photo-electric cells be allowed to receive the rays of only one sending mercury lamp. The light can be made invisible to the human eye and still work successfully.

Kaplan Ouster Upheld; Receivers Out; Criminal, Civil Cases Continue

DEVELOPMENTS during the month in the situation precipitated by the removal of Sam Kaplan and associate officers of Local Union 306 by the International Alliance were as follows:

1. Refusal of Hugh Frayne and John W. Davis to act as receivers, with George W. Alger, impartial chairman of the cloak and suit industry, and Samuel Rosenman, former counsel to ex-Governor Roosevelt, being substituted.
2. "Non-political" meetings of Local 306 members, in defiance of I.A. instructions, resulting in appointment of Harry Mackler, ex-306 president, as assistant receiver.
3. I.A. has receivers ousted. Appellate Division unanimously reverses action of Justice Cotillo in appointing receivers.
4. I.A. authority to oust Kaplan upheld by Supreme Court, with five-year ban against office-holding affirmed. Other officers also out but will be permitted to run after the "next election". I.A. concedes point in agreeing to hold election within 45 days from date of decision.
5. Four members win $10,000 verdict against Local 306. Kaplan ordered to render accounting.
6. Criminal action against Kaplan on coercion and conspiracy counts results in mistrial. New trial by February 14.

Promptly upon receipt of word from Messrs. Davis and Frayne declining to serve as receivers, Supreme Court Justice Cotillo appointed Messrs. Alger and Rosenman in their stead. These men, together with James Dunn, previously named, immediately assumed control of Local 306.

The I.A. immediately filed notice of an appeal. Application to presiding Justice Finch of the Appellate Division for a stay of the order of Justice Cotillo was denied, Justice Finch holding that the latter had apparently considered carefully both sides of the question and had acted in the best interests of all concerned. Expressing complete dissatisfaction with this decision, the I.A. prepared to carry its appeal to the full bench of the Appellate Division.

Then occurred an unusual but not entirely unexpected series of events. In open defiance of I.A. instructions, a group of 306 members, operating under the name of "The Committee", proceeded to hold a series of meetings which attracted an attendance of about 400 members. Advertised as entirely "unofficial" in character, with much emphasis being placed on the "no politics" angle, these meetings considered nothing but Local 306 business and provided an excellent political forum for aspiring office-holders. Harry Mackler, ex-president of 306, has in recent weeks emerged from semi-retirement to assume an active role in 306 affairs.

One of the first acts of this group was to appoint a committee of 15 men which, claiming indorsement of more than 400 card members, visited Justice Cotillo and prevailed upon him to name Harry Mackler as an assistant receiver in place of Morris Sternberg, a Kaplan man previously appointed. This move naturally tended to extend the sphere of Mackler's influence with the membership, and even while discharging these official duties as a representative of the court, Mackler continued to attend and actually preside over meetings of "The Committee" group.

Criticism of the I.A. and its officers was open and pronounced at these meetings. The same men who had pleaded with the I.A. to remove Kaplan and had expressed themselves as "looking for nothing", took the floor and castigated the Alliance officials for not having removed Kaplan earlier. Opposition to I.A. control of 306 totally ignored the fact that had the General Office given this group what they asked, there would have been no Local 306, the present circuit contracts of which accrued to it as a result of I.A. connections throughout the country.

Members Win Damages

Attention next was focused on the decision of Supreme Court Justice McCook in the case of four members of Local 306 who sought an accounting from and charged discrimination by Sam Kaplan as president of the union. This was the case that had been interrupted by the removal of Kaplan. Justice McCook, after stating that efforts to settle the case had failed, ruled that the plaintiffs had proved that Kaplan "ruled with an iron hand" and said that the fact that he used armed guards to protect his interests "tended to preserve his control, discourage opposition and intimidate dissenters". Continuing, the Justice said that "persistent critics and leading rebels like the plaintiffs could not expect to be in the good graces of Kaplan, and certainly they were not".

Awards of $2,000 each to Samuel Simon and Nathaniel Doragoff, and $3,000 each to Ernest Gieseman and Charles McDermott, who brought the suit, were entered. This $10,000 is expected to come out of the Local 306 treasury, inasmuch as the Kaplan acts complained against occurred while he was a Local officer.

Justice McCook also held that not only the four plaintiffs but the 1,300 regular members were entitled to an accounting of their money. The court ruled that there was waste in the payment of salary and gifts to Kaplan which "cannot be justified by a favorable vote no matter how obtained", since in three years Kaplan had received $100,000 in addition to what he obtained in previous years.

Appointment of receivers for Local 306 was hailed by the *New York World-Telegram,* which has long espoused the cause of the "opposition" members of Local 306. Just prior to the arguing of the I.A. appeal to the Appellate Division this newspaper printed an editorial which was interpreted in some quarters as constituting instructions to the court to consider the case in its "broad aspects" and sustain the receivership.

"Kaplan in or out" was the basis of the argument presented to the Appellate Division by Charles H. Tuttle, ex-Federal District Attorney, who was selected by the I.A. to argue the appeal. Ignoring the question of the right of any court to appoint receivers for a Local Union

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S.R.P. Dot Outline Is 'Secret' No. 7,214

A CURRENT laugh is one stemming out of the successful efforts of the Projection Practice Committee of the S.M.P.E. to secure studio cooperation in the matter of outlining in white the black dots on the S.R.P., so that Mr. Projectionist may see the dot even against a very dark background. Several studios agreed to the proposal and are now making the change in their prints. A release was sought on a studio letter of acceptance of the idea; but the answer was that the release was not compatible with studio policy.

This latest manifestation of the Hollywood "secrecy complex" comes at a time when company "secrets" are being bandied about on every Hollywood corner and technical "tricks" are blazoned on the pages of countless magazines.

Control console of the Thyratron Tube system of effect lighting which is one of the outstanding features of the new Radio City theatres. One man can handle all effect lighting assignments by means of a system of pre-set switches which automatically bring on the desired effects.

against the will of its International, Tuttle asked only that an answer be forthcoming as to whether Kaplan and associates were in or out as officers of Local Union 306. If Kaplan be legally out, said Tuttle, there could be no question as to the invalidity of the receivership; but if Kaplan be illegally out, then the receivership should stand. Tuttle maintained that Justice Cotillo exceeded his rights in appointing receivers, inasmuch as the only question pending before him was that of Kaplan in or out, judgment on which could have been passed either by denying or granting the Kaplan application for an injunction restraining the I.A. from removing him.

Upholds I.A. Control

The Supreme Court, argued Tuttle, had no right to usurp the powers of an International and enter into the business of conducting a labor union, full provision for the conduct of which was made in the International constitution. Tuttle expressed the personal conviction that there could be no question as to the right of the I.A. to oust Kaplan and that, having ousted him, they could exercise control over Local 306 in any manner they saw fit, within the limitations of the Alliance constitution, of course, and also within the bounds of law and order.

Tuttle's argument was a brilliant legal foray, and he never lost sight of his thesis that he was less interested in the receivership than in the question of whether Kaplan was in or out. Decision on this point, said Tuttle, would clear the way to a decision anent the receivership. Asserting that Justic Cotillo's action was "unique and unprecedented in the labor movement", as the courts had established the practice of non-interference with internal union affairs, Tuttle contended that there was great danger that the court's action would sever the local's connection with organized labor by terminating its contractual relationship with the International.

Opposing the I.A. at this hearing was Kaplan and, by way of surprise, Doragoff who but a few days previously had been returned the victor in a bitter court fight with Kaplan. Obviously, the Kaplan and Doragoff forces had joined hands in fighting the I.A. on the receivership question. The contention of these opposition forces was that the I.A. had removed Kaplan and taken over the local illegally, an action which, they held, amounted to conversion not sanctioned by either the Local or I.A. constitutions. Justice Cotillo's decision was the result of necessity, contended the Kaplan-Doragoff attorneys, inasmuch as the I.A. had been adjudged unfit to control Local 306.

The Justices repeatedly questioned the combine's attorneys on matters affecting the power of a court to operate a labor union, to oversee and pay pickets, and to supersede an International in the control of a chartered local. One Justice expressed the opinion that if that which was charged by the combine were true, then the case properly should be presented to the District Attorney for action.

Attorney Tuttle swung back into action by citing the offer of the I.A. to post a $500,000 bond to guarantee its proper conduct of the affairs of Local 306.

Great Victory for I.A.

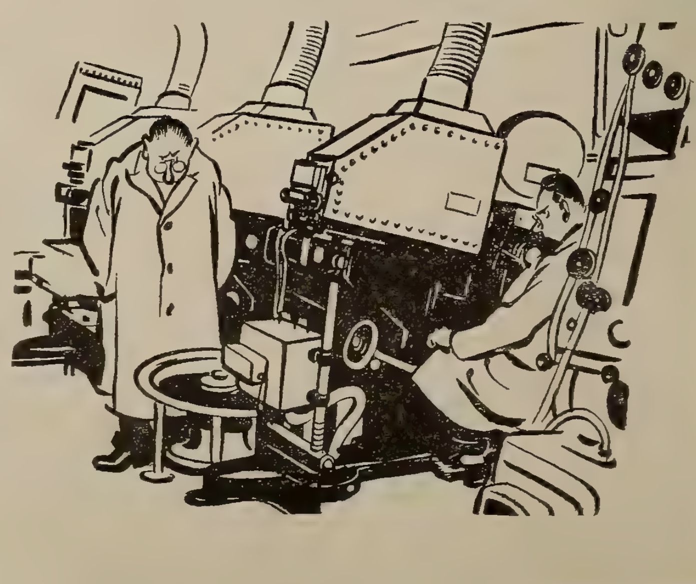
Within two days the Appellate Division handed down a unanimous decision to remove the receivers, with the I.A. being ordered to post a $500,000 bond to run during its control of Local 306. No opinion accompanied the decision, which was hailed on all sides as a smashing victory for the I.A. Neither Kaplan nor Doragoff asked permission to appeal.

The intervening period between this decision and the trial of the case of Kaplan vs. the I.A. on the score of his removal, was marked by the opening of the trial of members of Local 306 against Kaplan on the indictments for conspiracy and coercion which had previously been returned against Kaplan by the District Attorney of New York. It was this case which prompted the levying of a special $25,000 assessment against the members of Local 306 so that Kaplan might retain Max Steuer, noted criminal lawyer, in his defense.

This trial lasted less than a day, resulting in a mistrial after the prosecutor had exhausted every resource in efforts to have evidence admitted. Steuer evidently was in complete control of the situation, his objections against the introduction of evidence being sustained in nearly every case. Exasperated by the uninterrupted sequence of rulings against his every effort to introduce what he deemed relevant evidence, the prosecutor

(*Continued on page* 30)

Projectionists, sick of sex appeal, jungle lore and gunmen, wondering why someone doesn't make a film about food



The IP EDITORIAL PAGE

Vol. 4, No. 3 JANUARY 1933

The Lessons to be Learned From 306

No occurence in recent years has stirred the membership of the International Alliance as did the events attendant upon the removal of Sam Kaplan and associated officers from direction over Local 306. Here was a situation fraught with grave danger to the thousands of Alliance members, and had no action been taken for even six months longer, there is no estimate which would do full justice to the havoc that would have resulted. Now that the New York situation appears to have been clarified by a series of court actions which tend to strengthen the controlling hand of the I.A. over its local unions, it might be well if the whole matter be relegated to a minor place in the news, or better still, if possible, dropped from the news altogether. It is of the utmost importance, however, that the lessons learned in the New York battle be not soon forgotten.

Of great importance is the demonstrated insufficiency of the I.A. Constitution and By-Laws in any situation comparable to that which has existed in New York during the past three months. Shackled by the written word, agreed upon by all members of the Alliance in convention assembled, the General Office pursued a rocky course through the various courts. It was only when the matter of I.A. control over one of its chartered locals reached the higher courts, which are prone to a more liberal interpretation of delegated authority, that the General Office found itself on reasonably firm ground. It is desirable that at the next Convention there be a serious effort made to invest the General Office with more authority, so that there may be no repetition of the New York debacle.

The attitude of a certain portion of the Local 306 membership during that period when the I.A. was bending every effort to rehabilitate the Local also is worthy of note. Meetings called by certain members, identified only by the title of "The Committee", came within an ace of upsetting the whole program which the I.A. had fought so vigorously to maintain. A committee appointed at one of these meetings even went so far as to visit Justice Cotillo and in effect endorse the idea of a receivership in which one of its members should be included as an assistant. This action, bespeaking a preference for court control of Local 306 over that of the I.A., really was very funny: here were members lining up in opposition to I.A. control, despite the fact that the existence of the Local at that very moment depended solely on those circuit contracts which accrued to the Local *only* because of I.A. connections throughout the country. Also, a certain group within the Local went a step farther and deliberately aligned itself with those forces whose only reason for existence is an openly-expressed desire to "smash" all union labor. We doubt that we should have exhibited so much patience and displayed so much consideration for the larger issues involved as did the General Office in the face of such circumstances. Such processes also merit the attention of the next Convention—and they should not be forgotten in the interim.

President Elliott supplied the answer to many of the problems stemming out of the Local 306 mess when, at a meeting held to nominate officers for 306 there occured an outbreak of near-rowdyism, he stepped to the dais and quieted the storm by remarking: "You men show much spirit. Where was this spirit during the past four or five years?" In this one remark lies a full explanation of all the troubles besetting Local 306.

There can be no question, we think, as to the desirability of informing all Alliance members of the New York doings, and we are proud of the part played by INTERNATIONAL PROJECTIONIST in conveying the facts and helping to shape opinion relative to the matter. At the same time it might be well if Mr. Kaplan, and New York, and court actions, and $800,000, and the various other items incident to this case were "played down". Sufficient unto the day is the evil thereof. Let's turn our thoughts and direct our energies to other important work, of which there is no dearth.

The P.A.C. at the Crossroads

Pursuing an arduous course during the past three years, the Projection Advisory Council finally is confronted with a problem the failure to solve which may mean its disintegration. The recent mid-Winter meeting of the Council board of directors served to emphasize anew the fact that an outstanding fault of the projection craft is a pronounced lack of cooperation between its widely scattered units, plus its inability to take itself seriously. Much work confronts an alert and alive projectionist organization; but why should a mere handful of men give freely of their time and, often, money to help the craft when the latter is not only unappreciative but, in many instances, openly antagonistic to all efforts to do it a service?

The Council will shortly broadcast throughout the Alliance an appeal for funds, the character of the response to which will answer the question as to whether the organization is to continue as a potent factor in aiding the craft or disband. No one can deny that the Council has done splendid work in the face of almost overwhelming difficulties. The answer as to whether it shall continue in existence to fight the projectionist's battles can be supplied only by the men in the field. We urge that every Local extend itself to help the Council, which, when one stops to think of it, asks for so very little. The fact that the General Office of the I.A., and many of its officers, endorse the Council's activities should be sufficiently illuminative as to the importance of that work which the Council is doing and hopes to continue to do.

NEWS and VIEWS

A collection of random thoughts, and some not so random; fact, fancy and opinion pertaining to the projectionist and projection matters. The free-for-all forum.

Joe Hornstein Comments on Radio City

BEARING on the over-publicized "glories" of projection equipment and facilities in the new Radio City theatres (N. Y. City), is the following letter from Joe Hornstein, for years one of the outstanding theatre supply men in this country and now president of Continental Theatre Accessories, Inc.

I agree wholeheartedly with your comments on Radio City projection facilities which appeared in your December issue. You are correct in stating that the equipment in Radio City is not "unique"; but isn't there a possibility that "unique" equipment would hamper the good projection work now being delivered there?

You cite the advantages of the projection room in the Paramount Theatre in New York City, which was equipped in 1926, and it undoubtedly is true that this theatre constituted a marvelous advance in layout, facilities and equipment. With the untiring cooperation of Harry Rubin, I installed the equipment in this theatre. Both Mr. Rubin and I were particularly careful to discourage experimenters who attempted to have their equipment installed and practically turn the theatre into an experimental laboratory for new "wrinkles". We felt that equipment which had not proven itself should remain in the laboratory.

In supplying the equipment for Radio City theatres we used only standard equipment, and no attempt was made to make these theatres "the last word" through the medium of using equipment which had not been tested under actual projection room operating conditions. Radio City theatres are "the last word" in the sense that they utilize standard equipment in a sensible layout. After all, good projection is dependent not on the use of new "wrinkles" which require extraordinary efforts in care and operation but on the use of standard equipment which is thoroughly understood and intelligently used by the projectionist. A competent projectionist can "get by" even with substandard equipment; but the incompetent man cannot deliver good work with even the best equipment. Good equipment is, of course, desirable; but the projectionist is the key to a good or a bad performance.

Standard equipment which is thoroughly understood and intelligently used by the projectionist is the answer to many projection ills. It is this fact that makes possible just as good projection work by the man in a town of 500 people as is delivered by a man in a de-luxe theatre in a city of several millions population.

Thank you, Mr. Hornstein, for a come-back befitting an old campaigner. The Radio City theatres were the innocent victims of our "peeve" against those who emit "raves" upon the occasion of the opening of every theatre having more than 3,500 seats. We've seen just as good projection in small Missouri towns as we've seen on Broadway—probably better. If those things which were done in the New York Paramount in 1926 were carefully noted by projection men generally, we should hear less about the "innovations" of 1933, and the art would have been the beneficiary of proper layout and equipment in the intervening period.

No S.M.P.E. Disagreement on Academy Reel Length

REPORTS that the Society of Motion Picture Engineers would strenuously oppose the Academy recommendation of double (1,700-foot) reels have no basis in fact. While it is certain that this proposed standard will eventually have the attention of the Society, the mere fact that the plan still is very much in the proposal stage would operate to prevent either approval or disagreement by the Society. Reel length is not generally regarded as a pressing technical problem, and most of the Academy activity along this line is strictly economic in character.

Carbon Article Suggests a Review of Past Work

PUBLICATION in recent issues of I.P. of much data on carbons generated renewed interest among projectionist units in this important topic and served to emphasize the progress made in the development of the carbon arc to a high state of efficiency. That these articles served a very useful purpose is illustrated by the following summary of a lecture given recently by A. Smith before the Toronto (Canada), Projection Society, Local 173:

A recent article in INTERNATIONAL PROJECTIONIST has suggested a review of last year's work on the arc lamp as a source of light. Davy, about the year 1801, noticed that if conductors were separated when supplied with current from a battery, the current continued to flow as an arc. In the case of the carbon arc, we pointed out recently that not much of the useful light comes from the arc and that the chief source of light was the crater of the positive carbon. The temperature of the positive is about 3,500° C, the negative being 3,000° C.

According to I.P., however, it appears that in high intensity arcs about 30 per cent of the useful light comes from the tail-flame of the arc. Many theatres now use 18-20 amperes, but this rating is now often exceeded. The efficiency is about 1 watt per foot-candle.

Carbon is good material for arcs because of its high boiling point. Hot particles from the positive crater pass to the negative electrode, which should be pointed. The latter is not as hot as the positive crater, but the hotter it is, the steadier the arc. In general, as the current increases the area of bright positive crater increases also. The current density for low-intensity lamps is 120-165 amperes per square inch.

The point is made in I.P. that there is a best current value for every size electrode. The heated area moves around with low currents, and, again, becomes unsteady when the current is too high. It may be recalled that the consensus of opinion resulting from our general discussions was that on account of the aperture and the lens system there was no great advantage to be had from greatly increasing the size of the positive crater.

Voltage requirements for the correct operation of an arc is a very interesting topic. Usually more than 30 volts, this value decreases with the current. One formula given is:

$$\text{Volts} = 38.9 + \frac{11.7}{\text{amperes}} + \left(2.07 + \frac{10.5}{\text{amperes}}\right) \text{length of arc.}$$

Another formula is:

$$V = 36 + 51 \left(\frac{L + .8}{\text{amperes}}\right)$$

The resistance of the arc also decreases with the current. The result of both resistance and voltage decreasing with the current tends to make the arc unstable, necessitating ballast in series with the lamp. This is a resistance wire if D.C. is used; but if A.C. is used, it is a coil wound on iron, called a resistance.

The practice of holding review sessions at which articles published in periodicals are discussed by a group of projectionists should be encouraged. Very often the salient features of a given article are more clearly outlined through such discussion and not uncommonly much additional information is adduced.

Smoking a Bar to Good Theatre Projection

BUCKLING to a real or fancied call from underworked box-offices, many managers have rescinded the ban against smoking which has prevailed to date in practically all first-class theatres. What effect this action actually will have on the box-office is not known, but it cannot be denied that projection will suffer in smoke-filled houses. Smoking in theatres, aver its opponents, has the following disadvantages: (1) it imposes a further burden on the eyes (2) the odor of tobacco is not easily removed from clothing, and (3) inhalation of stale smoke for two hours or more is harmful physiologically and results in sending the patron out of the theatre with congestion of the lungs or throat, or both.

It is debatable whether as many customers will not be lost as will be gained through the lifting of the ban against smoking. Quality projection is not possible in a smoke-filled house, according to several investigations made by competent workers in the field.

Interesting Technical Note on Reel Lengths

OUR distinguished neighbor "Variety" contributes the following gem which makes painfully plain to all and sundry

can never, never be used in our surprisingly delicate projectors:

"Technically, the heavier reel affords many engineering problems in which exhibitor co-operation would have to be obtained, otherwise the show would start slow, reach normal speed in the middle of the unwinding, and from there on slip into a rush finis."

The only cure we see in sight for this sad situation is the addition to each shift of one man who will have but one job and that as follows: at the start of the reel (when it is heavy and therefore would "start slow") he would have to pull it down faster; at the middle of the reel (when it would "reach normal") he could rest, and from there on he would have to reverse the first action and pull back on the reel so that it would not "slip into a rush finis". Mr. Exhibitor will just *love* this advance in the art.

Improper Use of Magnascope Hurts Projection

THE use of Magnascope calls for the utmost discretion and faultless execution, as has been pointed out in these columns on several occasions. Sloppy use of the idea, or bad spotting within a subject, can do more harm than good. Lately there has developed a tendency to utilize a Magnascope color effect as a background for two-reel travel subjects and the like, the idea apparently being that this bit of color background will lend an "air" of authenticity to the subject. This is not the correct way to use Magnascope, and particularly not in color, as attention is diverted from the subject itself to the Magnascope background. Also, this combination of black-and-white picture and colored Magnascope effect background throughout the entire two reels imposes a severe strain on the eyes resulting from the sharp contrast provided.

This is one instance of where a good idea can be done to death.

ELECTRICAL TASTING

WHILE he was sitting at luncheon in the Westinghouse Laboratory in East Pittsburgh, Pa., it flashed on R. C. Hitchcock that an ordinary apple is acid and that the acid must have some electrical response. Out of sheer curiosity he inserted the two dissimilar pins of a very sensitive recording meter into an apple. "I got the shock of my life when the meter began to register," he says. "I immediately conducted the same experiment on an orange and a lemon with the same astonishing results."

Physicists will, of course, realize that Hitchcock had extended the discovery which Volta made 130 years ago and which ended in the invention of the battery. The two dissimilar pins were simply the poles of a battery, and the acid juice of the first of the fruit the solution, or electrolyte. With an instrument that could record one millionth of an ampere, it became possible to test fruits.

Testing in this case is more accurate that tasting. There is a distinct relation between acidity and flavor. With accurate charts of the current generated by the most luscious fruits and by the best foods with an acid content, possibly the whole system of testing and sampling will be revolutionized. A fruit with a sour taste has a high electrical reading, while a sweet fruit will register few microamperes.

EXCITER LAMP CURRENT VALUES AND FILAMENT SAG

R. E. Farnham

ENGINEERING DEPARTMENT, GENERAL ELECTRIC CO.

CAREFUL consideration has been given to the statement submitted to INTERNATIONAL PROJECTIONIST by way of comment on a recent contribution of the writer in which projectionists were urged to maintain proper operating values for exciter lamps, not only in the interest of a better show but, in the long run, of operating economies. It might be well to append hereto the statement under discussion.

Proper Lamp Setting

There has been some controversy regarding a 3.4 amp. setting versus a 3.8 amp setting (for a 4-ampere lamp). All lamp filaments, regardless of type, expand when current flows through them. The more current, the more expansion. At 3.8 the filament sags considerably more than at 3.4 amps. The more the filament sags, the more chance there is for it to vibrate while the projector is running. In short, the very minute movement of the filament in relation to the 'slit' in the optical system causes the ringing sound. If the vibration of the filament can be minimized, the ringing or 'machine noise' will also be minimized. Besides the added life received by using a low current, the exhibitor, who foots the bills, will be better satisfied."

Briefly expressed, the crux of the foregoing statement is a claimed advantage that in operating a lamp at 3.4 amperes instead of at 3.8 amperes, the lamp filament sags less and therefore is less likely to get out of optical alignment. Theoretically, this is true, and we (G.E.) encountered this trouble early in the design of these lamps. As a result, a certain amount of spring tension is given to the two lead wires so as to keep the coil taut and straight during the life of the lamp. The amount of this tension must be carefully juggled; if it is too strong, the tendency is to pull the coil out.

Furthermore, the turns of the filament coil have been wound to such a pitch as to produce a so-called solid band of light. The width of this solid band is considerably greater than is required by the optical system, with the result that there can be a slight departure of the coil from a true straight line, and the projectionist has a small amount of leeway in the vertical adjustment of the lamp.

I am inclined to believe that if the projectionist takes particular pains with the vertical adjustment of his lamp and gets the bar of light produced accurately centered, he will have little trouble with ringing noises as a result of filament vibration.

ANOTHER 2-MAN LAW

Two projectionists for houses of more than 1,000 seats is demanded in a new ordinance passed by the city commission at Memphis. Under the old ordinance only one man was required. A clause was also inserted demanding a $10 fee for license which must be renewed annually at a cost of $5. Old fee was $5 and renewal 50c.

ERPI-ULTRAPHONE SETTLEMENT

Electrical Research Products, Inc., and Ultraphone Sound System, Inc., jointly announce the termination by agreement of all pending litigation between them. Under the terms of the agreement Ultraphone recognizes the validity of Erpi's patents, agrees to refrain from any future infringement and will pay a royalty for past use of inventions covered by Erpi's patents.

The effect of this settlement is that any equipment manufactured by Ultraphone and covered by this agreement may be used by a customer of Ultraphone without liability to Erpi for infringement of patents.

ERPI WINS LEASE DECISION

A Western Electric Sound System had been leased to the tenant of the Strand Theatre, Monroeville, Alabama. Following the expiration of the exhibitor's lease the equipment had been left on the premises temporarily without any definite storage agreement with the owner of the premises. When it was decided to move the equipment, the owner of the premises refused to surrender it, claiming a lien under the Alabama statutes for the value of the use and occupation of the premises and a consequent right to possession of the equipment until the lien was satisfied.

ERPI sued the landlord to recover the equipment and the case was carried to the Supreme Court which decided the matter in favor of ERPI on all the points involved.

P.A.C. MEMBERSHIP DRIVE LAUNCHED

(Continued from page 14)

every local union for this communication. The Council is not asking for the impossible. All it asks is that projectionists generally heed the warnings apparent on every hand and make it possible for the Council to help them. Of work to be done there is no lack. The local unions themselves shall provide the answer as to whether this vitally important work *shall* be done."

Financial Support Needed

Finances and more widespread support among projectionists were discussed at length by the Council directors. It was agreed that while there was much work to be done in the near future, there was no apparent means at hand for doing it. Council finances are adequate only to maintain the organization, it was disclosed, with no funds available for undertaking and pushing to a successful conclusion that work which the board held to be the proper function of the Council. It was finally agreed to pursue that course outlined in President Barrows' statement: an appeal to every projectionist local within the Alliance for support and funds.

All data bearing on the two-men situation which has been collected by the Council to date, and which has been used by many local unions, was reviewed by the board. General agreement was reached that much new data now available should be added in order to bring the Council folio up to date. Service to those local unions and individuals who did not contribute directly to the support of the Council was held to be impossible, unless additional revenue were found. A report by Executive Vice-President P. A. McGuire showed that during the past year the services of the Council had been made available to all, irrespective of whether they contributed to the Council's support. Present conditions made it impossible to continue on this basis, said Mr. McGuire, unless additional revenue were forthcoming. It was agreed that in future the Council facilities should be made available only to those who contributed to its support or who, in the opinion of the President, were entitled to special consideration.

Plans were formulated for the membership drive which will get underway shortly. President Barrows expressed the opinion that few refusals of support would be had if projectionists generally were better acquainted with the work of the Council. Stressing the important work to be done, President Barrows suggested that a direct appeal for support be made to all projectionist locals, the response to which would indicate the scope of Council activity in the future.

Conference With I.A.

The meetings were interrupted for several hours during which a special committee of Council directors conferred with President Elliott and other officers of the Alliance. The outcome of this conference is included in the statement of President Barrows previously reported.

A resolution expressing the appreciation of the board to those members throughout the country who have given continuing support to the Council was adopted. President Barrows voiced the hope that the near future would see the completion of work of such importance as to repay those loyal workers who had given generously of their time and money in the past. Whether this hope would be realized, he continued, depended wholly upon the extent to which projectionists supported the Council.

The next meeting of the Council board of directors was set for the first week in May, the date to be announced later.

Kaplan Ouster Upheld; Receivers Out

(*Continued from page* 24)

impetuously cried that a gold medal should be presented to the defendant, Kaplan, with the thanks of the court.

Steur facetiously remarked that this statement sufficed to cause a request for a mistrial; and the prosecutor stunned Steur by immediately accepting. General opinion held that Steur had committed a blunder in submitting his motion, and the *World-Telegram*, during the course of a caustic editorial anent the trial, remarked that Steur had "outsmarted" himself and might not encounter such favorable conditions when the trial was resumed in a different court and before a different judge.

This trial will be resumed early in February.

The next court battle was staged before Supreme Court Justice Miller, with Kaplan and thirty associate officers appearing in the role of plaintiffs against the I.A. on the score of being removed from office and in being barred from running for office for five years. In dismissing the suit, Justice Miller held that the I.A. had given Kaplan ample opportunity to meet the charges made against him. However, the court ruled that thirty other local officers, whose removal also was upheld, would be permitted to run for office after the next election, which was ordered to be held within forty-five days. The decision in part follows:

"Briefly summarized, the statements and admissions refer to the methods of the officials of the local union in accepting new members; failure to report on some of the financial transactions; discrimination against out-of-town members; inability to account for funds which had come into their possession; the receipt by the president of many thousands of dollars without proper accountings; the interest of the plaintiff Kaplan in a supply corporation; other irregularities which caused litigation and the neglect of all the officials to attempt to remedy these and other conditions that had aroused public criticism.

"The explanation offered by the officials were deemed to be insufficient. Under the circumstances the executive board was justified in finding that the officials of the local union had violated the duties of their offices.

"While the determination that the officers removed shall be ineligible for five years for reelection may have been severe in many instances, still it was reasonable to impose some restriction for a definite period. Without some restriction the removals might have proved ineffective. Under the constitution and by-laws of the International Alliance there is a right to appeal to the international convention in 1934. This part of the determination may thus be reviewed."

In regard to the allegations of Kaplan that he had not been accorded a fair hearing by the I.A., the court said:

"I find that the action of the executive board was not capricious or corrupt, but was bona fide and that in arriving at its determination the board administered its own rules fairly and honestly. It announced at the inception of the investigation that its object was to pursue a sweeping inquiry into the action of officers of Local 306 and long before the investigation was concluded every officer was reasonably appraised that his tenure might be ended at its close."

I.A.'s 'Emergency' Rights

Upholding the right of an International to act in an emergency, the court said:

"The plaintiffs claim that the executive board did not make known to them the complaint and accusation against them on the various hearings and for that reason they were not given an opportunity to properly defend themselves. Assuming that the information given to the committee by persons who were not officials of the local unions was not binding upon the plaintiff, the statements of the officials themselves before the executive board and the admission drawn from them disclose they had violated the duties of their offices and were sufficient to justify the action of the board."

On its face a sweeping victory for the Alliance, this decision left matters pretty

much the same as they were immediately following the first decision of Justice Cotillo applicable to Kaplan's request for an injunction against his ouster and assumption of control of Local 306 by the I.A. This latter decision denied the Kaplan plea but imposed the condition that an election of officers be held immediately. It is not unlikely that Justice Cotillo would have been agreeable to an election within forty-five days.

Power of I.A. President

The basis of all argument in the series of court battles fought since Kaplan's removal has not been consideration of Kaplan's rights as an individual or as a Local Union officer but rather the demand of the I.A. that recognition be accorded its supervisory powers over one of its chartered units—whether the International President could suspend all laws, declare an emergency to exist and assume full control of a Local for such length of time as he deemed necessary to rehabilitate the unit. The Kaplan maneouvers merely provided a means for bringing this vital question out into the open.

It is impossible to adequately convey through the printed word a clear picture of the enormity of the task which faced the I.A. in its removal proceedings against Kaplan and his associates. The I.A.'s fight was not merely against an individual or a group of individuals whom it had removed from office in one of its Locals. Not at all. The I.A. was called upon to fight one of the most powerful combines in the form of an alliance of racketeers, money-men and politicians that has ever been marshalled in opposition to organized labor.

Election on February 10

The I.A. has set February 10 as election day for Local 306 officers, contingent, of course, upon the conclusion reached by Kaplan relative to an appeal from the decision which upheld his ouster. An appeal from this decision would operate to delay the election. At this writing the presidency of Local 306 seems to lie between Harry Sherman and Harry Mackler, with the candidate of the so-called Kaplan faction, Howard Paxton, being figured to run a poor third.

BARROWS, BURKE RE-ELECTED

Thad Barrows and James F. Burke have been re-elected president and business agent, respectively, of Boston Local Union 182. Re-election tops a record of long service to 182 by both men. A feature of the installation ceremonies was the presentation to Barrows of a gold life membership card in the organization, the honors being done by Burke in the form of an extended complimentary address. Barrows is also president of the Projection Advisory Council.

STRONG LABOR SUPPORT FOR OHIO UNEMPLOYMENT BILL

NOW that the American Federation of Labor has endorsed compulsory unemployment insurance the attention of the country is being focused on the State of Ohio, where "a true insurance bill" will be presented to the Legislature.

Recommended by a report of the Ohio Commission on Unemployment Insurance two weeks ago, the bill quickly drew the fire of chambers of commerce and employers' associations, but met with the support of labor groups, the League of Women Voters, the various consumers' leagues and welfare organizations.

Press 'Plays Down' Report

Except for the Scripps-Howard papers the press "played down" the report of the commission, which went up and down the State last year taking testimony from all interested parties, culminating in the preparation of a bill which the members believe is far superior to the Wisconsin proposal. While the latter's solvency would depend upon that of each of some thousands of individual plants—each company's funds are kept separate—the Ohio plan would make benefits available to the insured from a pooled fund, the solvency of which would be assured because the risk would be spread.

The bill provides that employers shall pay 2 per cent of their payroll and employes 1 per cent of their wage into the fund. Fifty per cent of the worker's weekly wage would be paid to him over a maximum of sixteen weeks after a waiting period of three weeks if he were totally unemployed. In any case, the benefits would not exceed $15 a week.

Hold Plan Insurable

It is estimated that had an unemployment insurance fund been established ten years ago and become operative in 1923, it would have provided for the unemployment existing from 1923 to 1929 and would then have had a reserve of $104,000,000 at the beginning of the depression. It would have been able to distribute $180,000,000 during the first two years of the depression, thus making any special efforts for unemployment relief unnecessary.

That the Metropolitan Life Insurance

HE who thinks that little of interest is brewing in the projection and sound fields these days is mistaken—very much so. Sources of power supply, square vs. round screen corners, an adequate national code, horn positioning and its accompanying problem of perforated or porous screens, extended frequency range recording and reproduction, double reels vs. single reels, two-men operation of projection rooms—all these topics are being talked about and provide much interesting grist for the mill. Lending impetus to all this activity is the probability that Unions will interest themselves officially in the *quality* as well as the *quantity* of work done by their members.

Company once held that unemployment was insurable is indicated in the commission's report, which quotes the late Haley Fiske, president of that company, as saying that the Metropolitan was "willing to experiment with unemployment insurance, and it has already formulated rough plans on which to work, once the Legislature has given us the requisite laws."

That was in 1925 at which time R. A. Hohaus, assistant actuary of the company, said that the problems of writing unemployment insurance were not insurmountable. Two years ago Governor Roosevelt vetoed a bill which would have granted a private insurance company the right to go into the unemployment insurance field; since then the Metropolitan has questioned the insurability of unemployment.

Threat to 'Orderly Government'

Stanley B. Mathewson, appointed by Governor White to represent the employers' view on the commission, in a supplementary statement issued with the report, says that he signed the majority report because he became convinced that "a do-nothing attitude on the part of employers is dangerous to the stability of orderly government." He would have preferred to endorse a constructive plan endorsed by the employers, but during the year in which the commission studied the problem he was convinced that many employers appeared to be more interested "in blocking any proposals" than in digging into the fundamentals of the problem.

In confidential letters circulated recently the Ohio Chamber of Commerce has sought to ascertain the actuarial attainments of Dr. I. M. Rubinow, a member of the commission who did the actuarial work for the commission. In these letters George P. Chandler, secretary of the Chamber of Commerce, said: "It has been our observation that here in Ohio and probably elsewhere the word 'actuary' is used with a freedom bordering on recklessness."

The joke was on the Chamber of Commerce which was not aware that Dr. Rubinow was a recognized actuarial authority, having organized the Casualty Actuarial Society eighteen years ago, becoming president from 1914 to 1916. He was also author of the Rubinow Accident Table and very active in the preparation of the workmen's compensation insurance rates in the early years.

The forces favoring unemployment insurance are now reinforced by labor organizations which either opposed the measures last year or were neutral because the American Federation of Labor had not acted. Now that affirmative action has been taken by labor's central organization, the struggle for and against the measure will be intensified.

FILM EDITING PROCESS

(*Continued from page* 15)

the results obtained when shown to an audience. Quite often certain situations which look very appealing during the process of cutting, fail to impress the audience and, likewise, certain situations which apparently do not seem to carry much weight in the studio projection rooms, bring a strong reaction from the audience. In this way, the director and everyone else concerned is enabled to judge, through the audience reaction, the screen values of all the situations in the picture, later removing such situations which prove non-essential.

Before a preview is held, however, there is a considerable amount of mechanical work that the picture must go through. First, there is the work of embellishing and refining the various cuts. Then the matter of adding sound effects and music and also the injection of certain photographic effects in the shape of lap dissolves and other effects to which the picture may lend itself. Today, with the perfection of the optical printer, these effects—such as lap dissolves, etc.,—which ordinarily were made on the sets by the director and which proved very costly because of the loss of time involved, are made on these optical printers after the picture has been completed.

Some studios have a special department which handles the injection of sound effects and music into the picture. At this studio, we find it more desirable to have the editor himself supervise this phase of the work, for the reason that he is thoroughly familiar with the film and also with the particular desires of the director and the manner in which they are to be placed. Our sound department concentrates on the making of the effects desired and also in the handling of the necessary music. There is also a close cooperation between our sound deparament and our sound library. When the editor is in need of certain sound effects or music for his picture, this particular track is ordered through the sound department. This department first refers to its files in the sound library and if the track is not already in the library, one is made. However, when a picture calls for considerable music or some special type of music, the sound department, of course, places this in the hands of a specially assigned musical director.

After both sound effects and music have been supplied the editor, he supervises the lining up of these particular sound tracks and both the effect tracks and the dialog tracks go through the process of what is called "dubbing"—which is also handled through the Sound Department by special operators for this purpose.

The work of dubbing presents a very interesting phase of motion picture production today. Dubbing has simplified to a great extent the making of sound pictures. Where originally sound effects were recorded at the time the scenes were taken, today all sound effects are placed in the picture after the scenes are taken —in fact, after the picture has been otherwise completely edited.

The disadvantage of trying to shoot a scene which carries a decided musical background is that the cutting of this particular sequence is confined to the continuity of the musical score and eliminations cannot be made without causing a noticeable break in the music. The disadvantage of recording sound effects at the same time dialog is being recorded is two-fold: it interferes at times with the coherence of the dialog and results in a changing volume of the various effects when the scenes which comprise the sequence are placed together. In fact, each cut is noticeable by the change in volume of this background noise. Once a scene has been recorded with sound effects in the background there is nothing which can be done mechanically to change the balance of sound effect and dialog, should the dialog be crowded out by the effect.

When dialog and sound effects are recorded on separate tracks, the prominence of the dialog may be emphasized to whatever degree desired in the "dubbing." The balance between the two may be varied at will, making the sound absolutely flexible in the hands of the dubber, and enabling him at all times to keep the dialog intelligible above the general noise level.

(*To be continued*)

International PROJECTIONIST

Edited by James J. Finn

February 1933
Vol. 4, No. 4

A magazine devoted to better visual and sound reproduction

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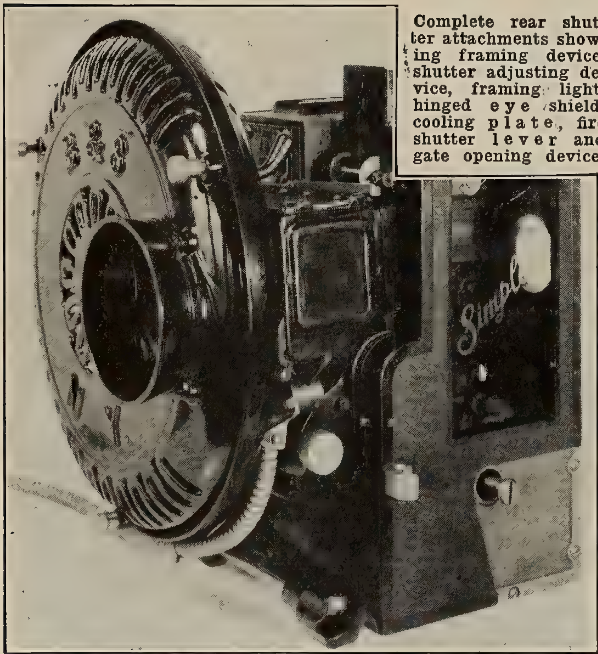
TWO NOTEWORTHY ACHIEVEMENTS IN PROJECTION EQUIPMENT



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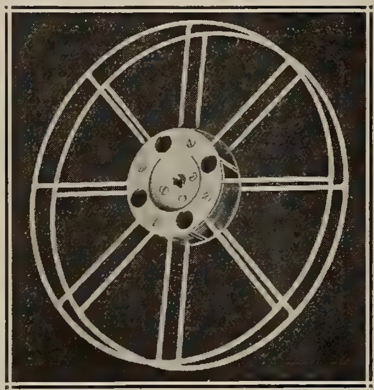

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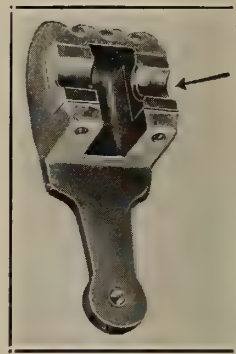

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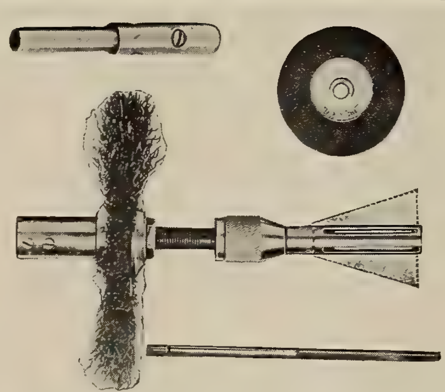

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MONTHLY CHAT

SPECIFICATIONS for the proposed new standard release print will be examined very carefully by all projectionists and particularly by their leaders. On the surface this project looks innocent enough, but it is not stretching the truth to say that producers and exhibitors likely will try to use the new, and longer, reel standard to buttress their argument that only one projectionist is required on each shift. Obviously, if producers and exhibitors insist upon the adoption of the new reel standard (described in detail within these pages), there is nothing in the ordinary course of events that projectionists can do about it.

Except for one or two minor changes, the new reel appears to be satisfactory technically. There are, of course, several substantial arguments in favor of the new reel, but then the same statement applies to two-men projection room operation. The exhibiting end of this business cannot expect to go on interminably seeking acceptance for its pet ideas without granting some leeway to the other fellow's point of view.

MENTION of two-men shifts reminds us of the fact that not a little of our time these days is being taken up by this subject. What with answering feverish pleas for help in the matter of statistics, arguments, advice on procedure and whatnot to various hard-pressed local and state association chairmen, the editor finds absolutely no time to devote to his proper function of getting out a publication. Appearances before three widely separated legislative committees within two weeks, in addition to attending to a raft of correspondence and much copy work—all on the two-men topic—makes exceedingly difficult the observance of publication dates . . . for which we beg our readers' indulgence. We wear our service stripes with poor grace.

IN the March 4 issue of *Liberty*, page 47, appears a story entitled "On the Count of Ten" which relates how one "Chunk" Mercurio met an untimely end as a result of trying to blast out the front of a theatre which had decided to go non-union instead of paying "a loafer to sit in the booth just to listen for sprocket-hole noise while another guy did the threading and rewinding." Still, in the same story, Mr. Exhibitor who relates the dolorous tale of poor business is able to "give the eye" to his two bodyguards and bustle out of the hall. That's the way with this business of ours: two bodyguards and one projectionist.

Rejoice we shall, however, for in the same story we operators are termed "projectionists." Thanks, *Liberty*.

PROJECTIONISTS members of the I.A. alone earn more than 26 million a year, more than half a million dollars a week. Yet, hardly a dime outside of regular organization obligations is paid to protect this stake. We wonder why?

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FEBRUARY 1933

FUNDAMENTALS OF VACUUM TUBE OPERATION

Eugene L. Bruyning, Ph.D.

CHIEF ENGINEER, DUOVAC RADIO TUBE CORPORATION

II

IN order to understand the action of the triode, it is essential that the principles underlying the two-electrode vacuum tubes are fully understood. These principles were fully explained in the preceding article, and the usefulness of such a device as a rectifier of alternating current was indicated.

In a triode, a grid is interposed between the cathode and plate. This grid, as the name implies, usually consists of a mesh or net-work of wires through which the electrons can flow to the plate. This simple addition of a third electrode has made a very much more versatile device out of the vaccum tube and has made it suitable for amplifiers, oscillators, and various other purposes.

Effect of the Grid

In a diode, the electrons emitted by the cathode are only under the influence of the potential or voltage applied on the plate. Their behavior, therefore, is very readily understood inasmuch as they obey a simple law of which the major factor is the voltage applied to the plate. In a three-electrode vacuum tube, on the other hand, we have besides the voltage that is applied on the plate, another voltage applied on the grid. This condition complicates the action of the device enormously, because the electrons not only obey the plate voltage but are also seriously affected by the grid voltage.

Let us see in exactly what manner the grid affects the electrons. Assuming that a certain definite voltage is applied on the plate which is not varied, a definite plate current will result. If we now apply a negative potential on the grid, it will be noticed that the plate current is decreased and that it decreases in the same proportion as the grid voltage is made more negative. The reason for this behavior is that the electrons emitted from the cathode are repelled by the negative potential of the grid so that less electrons reach the plate in any given time. It is also obvious that the magnitude of the grid voltage determines how readily the electrons are retarded, or, saying it in another way, with what force they are repelled.

The plate current, therefore, can be made to vary from any figure from zero up to the normal plate current by simply altering the magnitude of the negative grid voltage. If a positive potential is applied to the grid, just the opposite effect will take place, because this positive potential will accelerate the electrons and therefore aid them.

Due to the peculiar construction of the grid, very few electrons are attracted to it directly unless quite a high positive voltage is used. Needless to say, the magnitude of the positive grid voltage determines the increase of plate current. If we apply an alternating current potential on the grid, it is obvious that the plate current will vary exactly in the same manner as the grid voltage varies. We have, therefore, a device which acts as a relay. In other words, *the grid voltage variations are translated into plate current variations.*

If we place a resistance in the plate circuit, the plate current variations will be translated into voltage variations across this resistance. Depending upon the structure of the tube, the voltage variations across this resistance can be made to be greater than the grid voltage variations. The tube is, therefore, virtually an amplifier.

Voltage Values

The triode is usually used with a definite *negative potential on the grid* and a *definite positive potential on the plate.* It is common knowledge that an alternating current rapidly varies from a definite positive value through zero to an equal negative value. The rate at which it varies is call the "*frequency of the alternating current.*" An alternating voltage, therefore, goes through all values from zero to a definite positive potential, which is called the *peak,* back again to zero and then to a definite negative po-

tential, and from that back again to zero.

If such an alternating voltage is impressed on the grid of a triode, the grid will assume very rapidly all potential from zero to the peak value of the alternating voltage. If no negative potential is applied on the grid and an alternating voltage is applied to it, the grid will become sufficiently positive at times to draw current. If, however, we place a definite negative D.C. voltage on the grid by means of a battery, which is called a "C" battery, and then superimpose an alternating voltage on the grid, it is readily seen that the grid of the triode will not draw as much current.

"C" Battery Values

The value of a "C" battery, therefore, should be at least equal to the peak of the alternating voltage that is to be applied.

It is this limitation of triodes in general (the fact that the grid will draw current if it becomes sufficiently positive), which necessitates the design of various types of amplifiers so that they can be used with either small input voltages or large input voltages.

The extent to which a triode will amplify the grid voltage is dependent on its structure. The ratio of the magnification is called *the amplification factor.* It is obvious that the greater the amplification factor, the more readily will the grid voltage affect the plate current.

Amplifying tubes are classed according to the purposes to which they will be used into the following two general classes:

Input tubes or voltage amplifiers, and output tubes or power amplifiers. The real difference between these two classes is simply a matter of design. Input tubes have invariably a higher amplification factor than output tubes and are also very much smaller in design. We will now consider the reason as to why they are smaller.

Cathode Area Important

Let us assume that we have two vacuum tubes exactly alike in every respect, except that the cathode in one is much larger than the cathode in the other. Moreover, that the power consumed by the larger cathode is much greater than that of the smaller one, so that the cathodes' temperatures are equal. If the same voltages are applied to the plates, the plate currents in these two tubes will be proportioned to the cathode areas. It will also be noticed that an increase of plate voltage brings about a greater increase in plate current in the tube with the larger cathode. The same will apply also to the grid voltage.

The tube with the larger cathode can stand a greater negative grid voltage than the other to obtain the same plate current. It is assumed that the plate areas of these two tubes are so great that the plate current would not be affected by further increase. The final conclusion is, therefore, that the tube with the larger cathode can have a greater negative grid voltage so that when an alternating current is impressed on it, the amplitude of the positive half-cycles can be proportionally greater without bringing about a grid current in the grid circuit. Also, output tubes have much larger cathodes which consume greater power, and they naturally have larger plates in order to dissipate the heat caused by the drop inside the tube.

In this article we are dealing only with the behavior of input tubes or voltage amplifiers. In sound motion picture amplifiers the feeble current from the photo-electric cell is caused to flow through a high resistance which in turn causes a voltage drop. This voltage which varies in the same manner as a current through the photo-electric cell is impressed on the grid of a vacuum tube.

This first tube works at a sufficiently high bias so that no grid current flows even while the voltage from the photo-electric cell is most positive. Due to the fact that no grid current flows, the resistance of the grid circuit is very high and therefore, very little power is consumed. The grid voltage is amplified in the manner previously explained so that a proportional larger plate voltage variation is brought about across the load resistance. This load resistance in some manner is coupled with the input of another tube where the process is repeated. The voltage from the first tube is enormously amplified through succeeding tubes before it reaches the output tube, so that various phenomena that occur must be taken into consideration.

Typical '64-type tube

Microphonic Response

The first of these considerations is the microphonic response. Due to the vibrations of the projection equipment, the electrodes within the vacuum tube vary in respect to each other. If at this point we consider that the distance between the electrodes, as well as the area of the electrodes, determine the characteristics of any vacuum tube, it will be understood that as a result of this variation brought about by the vibrations of the projection equipment, the characteristics of the tube will be minutely varied at exactly the same rate as the vibrations of the equipment. The output of the amplifier, therefore, will vary in intensity with the rate of the vibration, which virtually amounts to a decided hum. Input tubes of high-gain amplifiers, such as are used in sound projection equipment, are especially designed to insure rigidity. A typical example of such a tube is the Duovac '64 type tube.

Internal noises within the input tube are also very objectionable, inasmuch as they are amplified simultaneously with the signal proper. The internal noises are mostly due to static charges which are built up within the insulators, such as the glass which is used in a tube, and which periodically discharge and cause a crackling sound. Special care is taken in such tubes to shield or eliminate these insulators so that this objection will be alleviated.

The succeeding tubes are designed so that the farther removed they are from the input, the greater becomes the negative voltage employed. The amplification factors of the intermediate tubes, therefore, are slightly lower than that of the input tubes. A high gain amplifier should, therefore, theoretically be designed to employ a series of identical tubes, identified from the standpoint of power consumption, but varying in amplification constant. The farther away from the input, the lower the amplification factor. In practice, this is generally not the case.

The amplification factor is not the only consideration in the design of vacuum tubes for amplifying circuits. In practice, one may see amplifiers so designed that the output tubes have a higher amplification constant than input tubes, but they are invariably very much larger in design.

In the next article, in which the other characteristics of triodes will be explained, it will become more clear why this discrepancy exists.

OPERATING PRECAUTIONS FOR EFFICIENT CARBON ARC

Engineering Department, National Carbon Co.

Carbons and arc lamps have kept pace with the development of projection equipment to its present state of high efficiency. The proper operation of the carbon arc, however, still is greatly dependent upon the skill and knowledge of the projectionist, to whom the subjoined hints on proper carbon arc operation should prove highly interesting.

THE modern motion picture projector is a very reliable mechanism. Although subjected in some instances to intense heat it will, if given proper care, last a long time and give excellent service. It is essential, however, that reasonable attention be given to the maintenance of all elements of the projector and particularly to the projection lamp. For that reason a resumé of operating precautions which will aid the projectionist in obtaining maximum efficiency and reliability in the operation of projection lamps should prove beneficial.

Carbons should always be stored in a dry place. They are porous and will absorb moisture if stored in a damp location, with the result that sputtering at the arc will be experienced. National Projector Carbons, for example, are thoroughly dry when they leave the factory but there is always the possibility of exposure to dampness during shipment or storage. For this reason, the practice of some projectionists of laying a few carbons in the lamphouse or on top of a rheostat before burning is to be commended. Carbons are not perishable. A damp carbon, after being thoroughly dried, is as good as ever.

Proper Contact Essential

Carbon holders must be kept clean and their contact with the carbons firm. The projectionist should give frequent and careful attention to the holders, removing all effects of corrosion or burning so that smooth, firm contact of full area is maintained. Defective contact between carbons and holders is a frequent cause of spindling.

It is likewise essential that feed rollers on high intensity condenser and high intensity reflector lamps be kept clean and in good condition to insure steady and accurate rotation of the positive carbon, maintain a symmetrical crater, and prevent possibility of jamming.

Carbons should always be operated within the recommended current range. If operated at a current lower than that recommended, the efficiency is greatly reduced for reasons that have been explained in detail on numerous occasions. Currents above the recommended range cause spindling, short life and unsteady burning, with very little advantage in the form of increased volume of projection light.

Carbons must be kept in proper alignment. Poorly formed craters and lowered efficiency of light production are invariably encountered when the correct alignment of the carbons is not maintained. If the allowance for movement of the carbon holders is insufficient to establish exact alignment, the desired result can usually be obtained by the use of shims. Particular attention should be given to the lateral alignment of the carbons.

It is equally important, in attaining full efficiency of light production, that the crater of the positive carbon be kept in the correct position relative to the optical system. Modern lamps are equipped with gauge pins or with means for projecting the arc image on a chart at the side of the lamp housing which indicates the correct location of the positive crater. The feed of the positive carbon should be regulated to maintain the crater as near as possible to this position throughout the burning period. The feed of the negative carbon should also be adjusted to maintain correct and uniform arc length during operation. In some types of lamps, having automatic feed, operation with too short an arc prevents adjustment of the feed mechanism to a point which maintains the carbons in proper relative position.

If it is found that a more desirable screen illumination is obtained with the positive crater out of the indicated position, it will usually be found that the condenser or reflector has also been displaced. In such cases, the optical system should be adjusted so that best results are obtained with the positive crater in the position indicated as correct.

Cleaning and Lubrication

The lamp housing and mechanism should be cleaned regularly and thoroughly and all moving elements of the lamp mechanism kept well lubricated with oil or grease of the consistency recommended by the lamp manufacturer. Complaints sometimes arise from hard grease clogging the feeding mechanism and interfering with the feeding of the carbons. Such troubles can be eliminated by cleaning out the hard grease and replacing with a grade of the proper consistency.

Keep condensers and reflectors clean and well polished. When reflecting mirrors begin to show disintegration of the silver coating or a grayish color, they should be re-silvered.

Instructions for adjusting the position of the optical elements of the lamp are provided by the manufacturer. These should be carefully followed when the lamp is installed and the correct position maintained by adjustment whenever necessary.

Alignment of the lamp with the projection head should be checked from time to time and adjusted when found incorrect. Keep all electrical contacts throughout the lamp circuit clean and firmly tightened so that full area of contact is maintained.

Care of Instruments

Particular attention to the care of electrical instruments will be well repaid. Ammeters, voltmeters and wattmeters are necessarily of somewhat delicate construction and the best instrument may be ruined by misuse. Meters should never be placed where they will be exposed to high temperature, vibration, or strong magnetic fields. Such conditions may quickly impair their accuracy. They should be calibrated at regular intervals, *at least once a year.*

The projectionist should not attempt to adjust or repair electrical meters. When attention is required they should be returned to the manufacturer who has proper facilities for making the needed repairs and adjustment.

Make sure that the contacts on all external connections to electrical meters are clean and firmly secured.

Rheostat Overloads

Damage to reheostats sometimes results from operation with a short arc at an arc voltage appreciably below normal. This practice throws on the rheostat a greater proportion of the line voltage than it is designed to carry, so that the arc current can be held down to normal value only by cutting out some of the parallel connected resistors. This may force the remaining resistors to absorb so much wattage in excess of their radiating capacity that destructive temperatures result. With correct arc adjustment ample range of current control should be afforded by normal operation of the rheostat.

Careful attention to the foregoing precautions and to the more specific instructions given emphasis previously for the type of lamp in use, will afford the projectionist using a good carbon, screen illumination of maximum steadiness, brilliancy and uniformity.

THE MAINTENANCE OF MOTOR GENERATORS

A. C. Schroeder

MEMBER, LOCAL UNION 150, I. A. T. S. E., LOS ANGELES, CALIF.

II. *Fitting Brushes Properly. Armature Troubles*

PROPER fitting requires that the brush be lifted and sandpaper placed between it and the commutator, with the back of the paper next to the commutator. The brush then is dropped, and the paper is drawn past it in the direction that the commutator turns. This latter instruction is extremely important, because if the paper be drawn through in the opposite direction, the brush will be improperly fitted. This process is repeated until the brush is fitted.

At A in Figure 3 is shown the correct way to accomplish this. There is a slight amount of play between the brush and its holder, which is necessary so that it will not stick. The arrow within the curved line shows the direction of rotation of the armature, the curved line representing the commutator. The brush touches the lower part of the holder at the right, while at the upper end it touches the holder at the left. XX represents the strip of sandpaper.

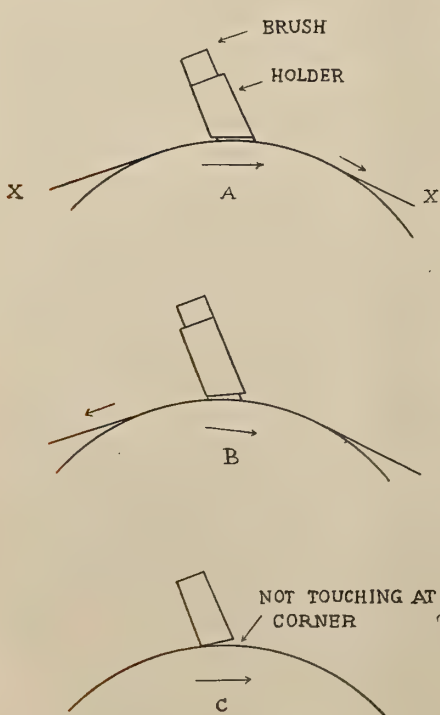


Figure 3

When the sandpaper is drawn in the direction shown by the arrow above it, the brush is pulled into the same position as it occupies during normal operation of the machine, and this fit will be right. If the paper be drawn the other way, as shown at B, the brush is tipped the opposite way in the holder, consequently changing the angle it makes with the commutator. If the brush would stay in this position when in normal operation, everything would be in order; but when the machine starts, the brush assumes the position as at A (Fig. 3) with the result that the face of the brush does not fit the commutator. This is shown at C. Not only will this cause overloading of the brush, as a small area has to carry the current that the entire brush is supposed to carry, but it will cause sparking and improper commutation.

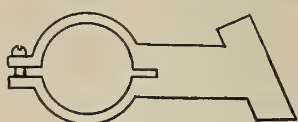


Figure 5

It is important that the sandpaper be carried around the commutator as far as possible. If the paper is used as in Figure 4, at A, the edges of the brush will be too short, as at B.

After the brush is sanded, it is put in position and the machine run a short time—a half minute is sufficient. The brush then is removed and inspected to see how the fitting was done. Assuming that the shiny portions touch the commutator but the dull parts do not, the brush should be fitted some more. It does not take long to get the entire surface to touch.

Be sure to fasten the pig-tail under the screw firmly. There have been instances where this was completely forgotten, with the result that the current had to flow through the spring that kept the brush against the commutator. This spring is not intended to carry current, and as they are usually made of steel, any great amount of current flowing through them produces heat, which is likely to draw the temper and render them unfit for further use.

Not only must the pig-tail be firmly fastened but before it is put into place, see that the surfaces are clean. These surfaces become oxidized, causing a rise in resistance at the joint, which condition will again force the current to go through the spring.

Care should be taken to insure that the brush holders are not moved from their normal position. They are often mounted as shown in Figure 5. If the clamp screw is loose, the holder can be twisted on the shaft. When one of the holders is twisted out of place the result is shown in Figure 6, where the right brush is further down the commutator. Not only must these brushes be in line with each other, but they must also be spaced equally around the commutator. This can be ascertained by counting the number of segments from the tip of one set of brushes to the tip of the next set.

In Figure 7 the armature is turned until the tip of the brushes at 1 are just at the edge of one of the commutator segments. Count the number of segments between this point and the tip of the brushes at 2, which should also be at the edge of a segment. From this point the segments are counted to the tip of the brushes at 3, and so on. There must be the same number of segments from 1 to 2 as there are from 2 to 3, or from 3 to 4, or 4 to 1.

It makes no difference how many sets

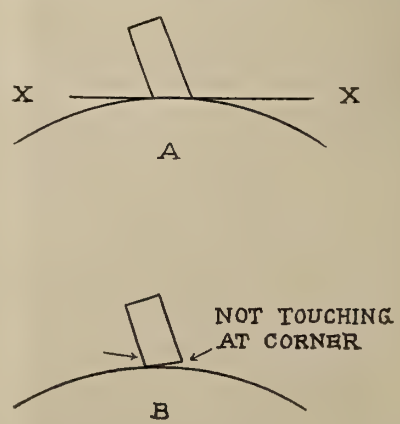


Figure 4

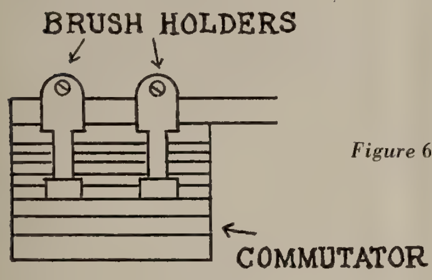


Figure 6

of brushes there are. If there were only two, we would count from 1 to 3. Number 2 set would not be there. Then count from 3 to 1. The place where the number 4 set is would also be unoccupied. Similarly, if there were six or more brushes, we would count from one to the next, then from that set to the following set, and so on. Any brush that is out of place must be moved to the proper position and then sanded.

It is usually possible to move the entire brush rig with or against the direction of rotation. Sometimes the end casting can be shifted. Often there will be marks showing when this is set in the position for best commutation. If these marks are gone or the brushes are sparking anyway, as a result of having been shifted from the neutral position, they can be returned to the proper position by shifting them until the sparking is at a minimum while the machine is delivering a normal load. *Be sure to lock the device again.*

ARMATURE TROUBLES

TROUBLES in the armature are hard for the projectionist to find and often impossible for him to repair. They usually manifest themselves by sparking at the brushes, as previously mentioned. Short circuits reduce the output of the machine or cause it to fail entirely. They can sometimes be found in the commutator or in the wires connected to it. If such is the case, the particle causing the "short" in the commutator can be removed or the wires "shorting" can be separated and either taped or some empire cloth put between them and shellacked into place. Shellac should be used even if the wires are taped.

Open circuits become evident by violent sparking and burning of the commutator. Often there will be a ring of fire around the commutator. If this keeps up for any length of time, a flat spot will be burned in the commutator, making it necessary to turn it on a lathe. If accessible, it can be repaired easily. If it cannot be reached the coil can be "shorted" out by soldering a jumper to the two bars to which it is connected, and the machine used until the show is over.

The two bars connected to the open coil can be found by the use of a battery and an indicating device, such as an ammeter. Lift the brushes from the commutator. Connect the battery and meter as shown in Figure 8. Place the test point on adjacent bars and adjust the current so the meter reads as close to maximum as can be conveniently arranged. This is done because we must find the open coil by the *difference* in the readings, and the greater the reading we start with, the larger will be the difference when we get to the defective coil. It is best to adjust the current by using more or less battery or by using a meter having a different range, rather than by placing resistance in the test circuit to cut it down. When resistance is put in the test circuit, the difference in the readings will be less.

Figure 9 shows how the coils are wired to the commutator. In testing from one bar to the next the current will flow only through the coil connected to those two bars. It cannot flow through the rest of the armature on account of the open coil. However, when we test across the faulty coil the current cannot go through it, but flows through all the other coils. The current will be greatly reduced as a result of the increased resistance. These two bars are now connected by soldering a jumper wire to them—and the show can go on. Do not leave it this way indefinitely; it must be repaired the next day.

A grounded armature may or may not cause trouble. If the system is not grounded elsewhere a ground could be present in the armature for months without its presence ever being suspected. If a second ground occurs, it will have the same effect as a "short." If the system is normally grounded and a ground then develops, it also forms a "short." To test for a grounded armature lift the brushes, place one test point on the shaft and the other on the commutator. A reading shows a ground. (It may be either in the commutator or in the armature.) In this test a voltmeter must be used, as an ammeter usually would be ruined.

Loss of Magnetism

Loss of residual magnetism is sometimes baffling. Fortunately, it does not occur frequently. It is only necessary to send a current through the field using an outside source as a battery or another

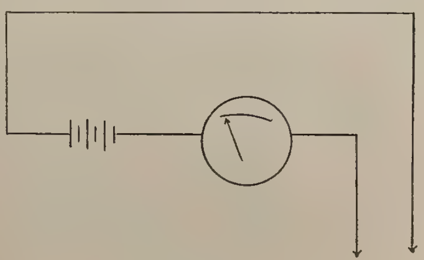


Figure 8

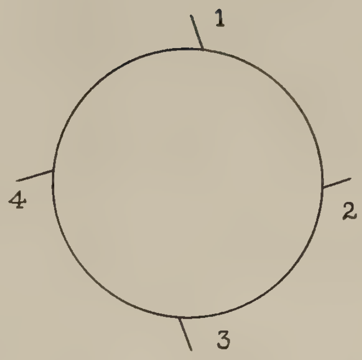


Figure 7

generator. The writer once used a mercury arc rectifier to remagnetize the field of a generator. The only harm that can be done, as a rule, is to reverse the polarity of the machine. If this happens, send the current through the fields again but in the opposite direction.

First method: Lift the brushes, then connect the positive of the magnetizing current to the positive brush, and the negative to the negative brush. If it is not known which is which, try it one way and if the polarity comes up backwards, reverse the connections and shoot it again. Break the circuit very slowly, so as to draw a long spark, causing the current to die away more slowly than it otherwise would. Turning back the field rheostat before opening the circuit helps. If the current is broken too rapidly, the voltage set up by self-induction may be great enough to puncture the insulation of the field coils. *Caution: Do not touch the two wires where the break occurs.* You may get a powerful shock.

Second method: The field circuit may be opened at one of the brushes and the magnetizing circuit connected in there. The negative of the outside circuit must be hooked to the positive brush, and the positive wire is hooked to the field coil that was disconnected from the brush. With this method the brushes must remain on the commutator to complete the circuit. In either case the shunt field is the one to use, as it does not require so great a flow of circut. The external circuit of the generator must be open, otherwise the greater portion of the current might go hopping around through the arc lamps or elsewhere. This also ap-

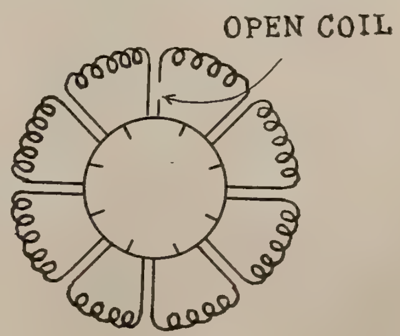


Figure 9

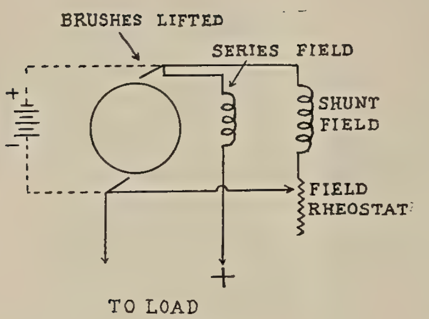


Figure 10

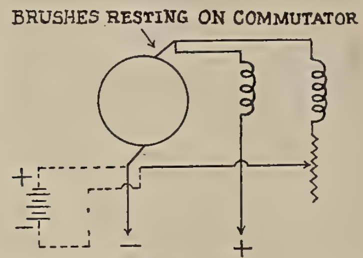


Figure 11

plies to the first method. Figures 10 and 11 show the two methods. In both figures the dotted lines show the temporary outside circuit.

It has been said that someone tried to start a generator with the field rheostat turned clear back. This is often cause enough for lack of current. Of course, turning up the rheostat remedies the difficulty. Some machines will not build up if the external circuit is closed through a fairly low resistance. Be sure the load is off the machine before starting.

Only a few words need be added in conclusion. Keep all connections clean and tight. Don't leave loose objects lying around the machine. Blow the dust out occasionally with bellows.

Harry Sherman Elected President of 306 in Spirited Campaign

IN a whirlwind campaign of only three days' duration, Harry Sherman was elected President of Local Union 306 over two other opponents in the recent election sponsored by the International Alliance to fill the vacancies caused by the removal from office by the I.A. of Sam Kaplan and 21 other officers of the union. Sherman polled 530 votes, as against 350 for his nearest rival, Harry Mackler, with 93 votes going to Howard Paxton. The latter's vote was very significant inasmuch as his candidacy had the active support of the so-called Kaplan faction in the Local.

Deciding to run practically on the last day on which nominations could be filed, Sherman in three days' time completely upset a Mackler campaign of some nine weeks' duration, during a portion of which time Mackler enjoyed some advantages through the medium of his appointment as one of the assistant receivers for the union. The Sherman campaign was waged on a platform which included the following:

1. Restoration to 306 of houses that had been lost to Empire State.
2. Complete revision of constitution and by-laws.
3. Regular financial reports.
4. Withdrawal of Union from all subsidiary activities, such as motorized sound service and open-air free shows in non-union districts.
5. Free speech and equal rights.
6. Elimination of Empire State Union, which now controls 279 theatres in the Metropolitan area.
7. Appointment of a committee to formulate a budget and determine how much it really costs to run the Local.
8. Election of business agents instead of appointment, and reduction in number of delegates from four to two.

Sherman's campaign was marked by the complete absence of all mud-slinging and disorder which heretofore has characterized Local 306 elections. Admitting the good qualities of his opponents, Sherman bid for support on the basis of his program and insisted upon the exclusion of all personalities from his meetings. He was frank to state that if the membership really believed that any of the other candidates was better fitted for the office than he, the other man should be elected.

Improvement or Resignation

A salient feature of the Sherman campaign was his oft-repeated promise of very definite improvement in Local 306 affairs within four months, failing to accomplish which he would resign.

In addition to the office of president the Sherman forces gathered in six out of a total of ten memberships on the Executive Board, and elected their men in the offices of Treasurer (Charles Hyman); Financial Secretary (Charles Beckman); one Trustee (Harry Bergoffen); and the Sergeant-at-Arms (Tom Michaels). Other officers are: Vice-President, Charles Thide, and Recording Secretary, George Reeves.

The salient features of the election were two: first, the circularizing by wire of a majority of I.A. Locals by one of Sherman's opponents in an attempt to secure data which would tend to disprove Sherman's labor sympathies and discredit his campaign, and (2) the meeting in joint debate of Sherman and Mackler on the night preceding the election. The latter procedure, the result of an immediate acceptance by Sherman of a Mackler defy to meet him on the same floor, is unprecedented in the history of Local 306 and, probably, in many other large locals. The Sherman adherents do not deny that this last debate meeting sealed Mackler's fate and insured the election of their candidate.

HARRY SHERMAN

The new leader of Local 306

Sherman has had a most interesting career since 1917 when he was admitted to Local 306. Serving the Local in several offices, he finally was called to the General Office of the I.A. as an organizer. Subsequently he was named assistant I.A. president and served several years in this post.

In 1926, when the large exhibiting chains were being formed, Sherman accepted appointment as labor conciliator for Publix Theatres Corp., a job which he held up to the recent 306 election. Sherman's success in bridging the gap between his status as employer and labor leader positively is unprecedented in I.A. history and probably in the history of any other International.

As a representative of Publix, Sherman has visited every section of this country and in Canada, resident in which are a host of friends both in the labor and exhibition ranks.

KAPLAN CONSPIRACY, COERCION TRIAL NEARS END

The trial of Sam Kaplan and 21 associate ex-officers of Local Union 306 on counts of conspiracy and coercion neared its end in Special Sessions (N. Y. City) as these lines were written. The first such trial ended when Max D. Steur, noted criminal lawyer defending Kaplan, succeeded in having a mistrial declared.

Close observers at the new trial have opined that the bulk of the evidence submitted to date was in favor of the prosecution, the witnesses for the Sate appearing as strong as the Kaplan witnesses appear weak. On the stand Kaplan himself admitted that his salary was $21,000 a year, that he received $55,000 in "gifts" and that the expenses of the Union for 21 months were $1,200,000, a substantial portion of which amount could not be satisfactorily accounted for.

The case is one of the State of New York vs. Sam Kaplan, et al, with neither the I. A. nor Local 306 taking an active part in the proceedings.

PRINT RUNS 280 TIMES

The average number of bookings for each sound print of a feature at present is 35, with each booking averaging 2 days of exhibition or four projections. Thus, each print runs through a projection machine 280 times before it is discarded, according to figures released by the M.P.P.D.A. (Hays Organization).

CURVES: THEIR STRUCTURE AND HOW TO READ THEM

Aaron Nadell

IV

FIGURE 1 is a curve of the kind commonly made to portray the performance of a sound reproducing system. The vertical lines, as revealed by the information printed along the bottom of the rectangle, represent frequencies. The horizontal lines represent volume of sound, measured in decibels. A thorough understanding of this curve requires some knowledge of the nature of the *decibel*, as a unit for measuring the volume of sound, and also of the relationship between proper frequency response and the quality of reproduced sound as heard.

To begin with the second of these two requirements: Some portions of a sound reproducing system act to amplify the electric currents which represent the sound. Some volume controls, for example, decrease the power of those currents and, hence, of the volume that comes from the speakers. Good reproduction requires that whatever change—whether of amplification or reduction of volume—is made in the case of one frequency shall apply equally to all frequencies. The reason for this requirement is simple, its necessity unavoidable.

Effect of 'Highs'

The sound of the flute is high in frequency—or, otherwise expressed, in the number of sound waves emitted per second. That of the kettle-drums (tympani) is low in frequency. The conductor of the orchestra (and not the projectionist or the projection room equipment) must decide which of these two instruments is to sound the louder. If the reproducing equipment amplifies some frequencies more strongly than others, the sound of the orchestra will be distorted—it may be distorted out of recognition. The same requirements also apply to speech. If a man and a woman are talking in a pictured scene, the director, not the sound system, must determine which shall speak the louder. A woman's voice has a tone of higher frequency than a man's; both must be amplified to an equal degree.

In practical operation of present-day theatre sound equipment, the chief discrimination between frequencies lies at the upper end of the scale. Sounds of more than four or five thousand cycles are generally reproduced less strongly than others, and sounds much above five thousand, except in the case of the very newest apparatus, are often lost entirely. Speech is distorted and deprived of clarity through these losses: the "s" and "f," the "sh" and "ch" sounds are eliminated. To some extent the imagination of the audience functions to supply these when they are missing. But the naturalness and individuality of human voices cannot be supplied by imagination, and naturalness also is lost when the upper register is not fully reproduced. It is the presence of the higher frequencies, likewise, that makes it possible for the ear to tell one instrument from another: when they are missing, the violin may sound like a flute, the piano be indistinguishable from a harp.

The numbers along the bottom of Figure 1 represent frequencies of from 50 to 9,000 waves of compressed air per second. The curve drawn against the background of Figure 1 is intended to reveal whether these frequencies are being reproduced at substantially equal volume. The horizontal lines of this figure stand for volume, as measured in decibels.

The *decibel* is a unit of measure employed to represent sound volume, not according to the amount of electrical power used to produce it, not according to the air pressure of which it consists, *but as the ear hears it.* The response of the ear to changes in volume is logarithmic.

The spacing of the *vertical* lines in Figure 1 is logarithmic.

The horizontal lines in this figure are evenly spaced. That is because the values they represent are logarithmic values. They stand for decibels, that is, for the *logarithm* of a change in sound. Therefore, in this chart, the vertical lines, which represent frequencies and not the logarithm of changes in frequency, are given a logarithmic spacing in order to match them to the *values* of the horizontal lines and to keep the shape of the curve what it would be if the horizontal lines stood for watts, or dynes of air pressure, instead of for decibels.

A rough idea of the nature of a logarithm may perhaps be had from the elementary table below:

1 is	the	logarithm	of	10
2 "	"	"	"	100
3 "	"	"	"	1,000
4 "	"	"	"	10,000, etc

The changes in volume represented by the horizontal lines are, therefore, much greater, in actual power, than the figures at the sides of the rectangle show them to be. Those numbers show changes in volume, not as they are, *but as the ear hears them.*

Figure 2 is the same curve drawn without a logarithmic spacing of the vertical lines. The information conveyed by Figure 2 is precisely the same as that shown on Figure 1. The shapes of the two curves, of course, are very different, because they are drawn against different backgrounds; but if due allowance is made for that difference in the charts, they are identically the same curve.

The chart used in Figure 1 is usually employed in measuring the operation of a sound system, partly, perhaps, because the resultant curve is prettier, but also because Figure 1 is in a sense dis-

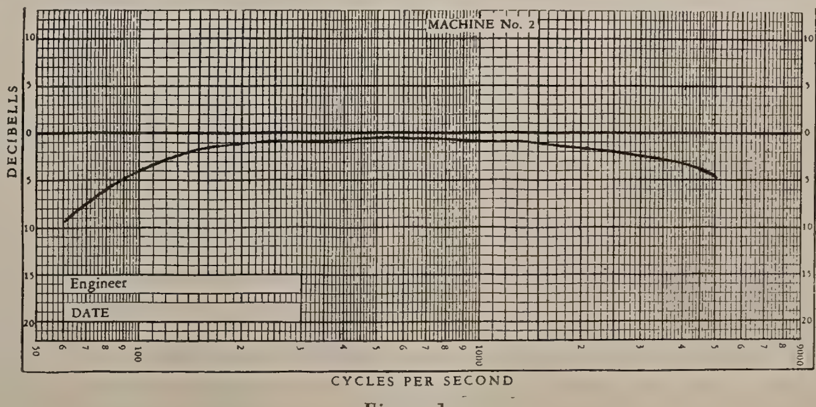


Figure 1

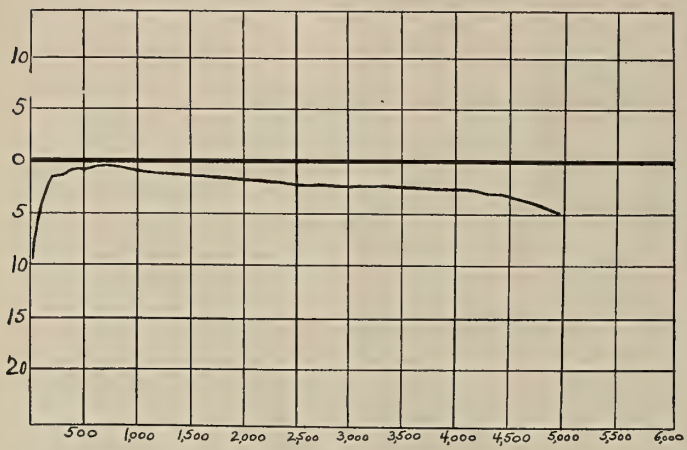


FIGURE 2
which conveys precisely the same information as is shown in Figure 1, which is drawn logarithmically

torted because it does not make allowance for the logarithmic nature of the horizontal values.

Many projectionists have seen a curve like that of Figure 1 made in their projection room. The process is fairly simple. It requires the use of a special reel (or record), upon which a number of frequencies—the pure tones, without the overtones or harmonics—have been recorded. A volume indicator is also necessary, one type of which commonly employed for making these curves is well known to projectionists.

The instrument is connected across the loud speaker circuit, and the reel is threaded up in the usual way. As each frequency is reproduced the reading of the volume indicator is noted. A voice recorded on the reel just before each frequency announces what frequency the next will be, and also the change in volume, if any, at which it was recorded. Any change in recorded volume, of course, must be taken into account before the results of the volume indicator are jotted down.

Sometimes those results are noted as a column of figures. Sometimes the engineer or other person making the test will mark down the same information in the form of a small cross upon a printed background like that in Figure 1. As each frequency is played he will mark, on the chart, the point where the line representing that frequency crosses the line representing the volume shown on the indicator.

The actual volume, or amount of amplification, is of no importance in this test, the only purpose of which is to determine whether all frequencies are being amplified equally, within the limits of present-day apparatus, and the only requirement is that the volume control of the sound system shall not be changed while the test is in progress. When all the frequencies carried on the test film are properly represented by small crosses set down on the chart, a continuous line is drawn connecting all those crosses. That is the curve shown in Figure 1.

Another method of making this same curve, previously stated, is to take down the information on a bit of paper, in the form of two columns of figures, and later use those to make the crosses on the graph and to draw the curve. The numerical representation of Figure 1 is given in Table A.

Figure 3 shows two curves of this kind taken in the same projection room, representing sound-on-film from each of the two projectors. The practical value of these curves is apparent at a glance. The two curves are not the same, and they should be. A short analysis reveals that No. 2 projector is doing rather poorly with the higher frequencies. Since it is the same type machine as No. 1, it is capable of better results and obviously is out of adjustment. The curve shows this very clearly.

Reproduction at some medium frequency, say, 1,000 cycles, may be taken as a standard. The curve for projector No. 1 crosses the 1,000-cycle vertical line at a level of —4 decibels. At the 5,000-cycle line this curve is at —7, which is "down" 3 db. The curve for projector No. 2 crosses the 1,000-cycle line at plus 1, but at 5,000 cycles it is down to —11, a difference of 12 db. Also, the curve of No. 2 begins to drop before it reaches 1,500 cycles; while that of No. 1 holds up pretty well to the 3,000 mark. Obviously there is something wrong with the high-frequency response of No. 2 projector. The trouble in this particular case was found in the

Table A

FREQUENCY (*In cycles per second*)	VOLUME (*In decibels*)
60	—10
70	— 7.5
80	— 6
90	— 4.75
100	— 4
150	— 1.75
200	— 1
250	— 1
300	— 1
350	— .75
400	— .5
450	— .5
500	— .5
	etc.

adjustment of the exciting lamp focus, which is very often responsible for poor reproduction of the higher frequencies.

Now in another respect No. 2 projector shows up as superior to No. 1 and that is at the lower end. Both curves are "off" 11 db. at 60 cycles, as compared with 1,000, but No. 2 holds up pretty well right down to 150 cycles. Number 1, on the contrary, drops off at the 300-

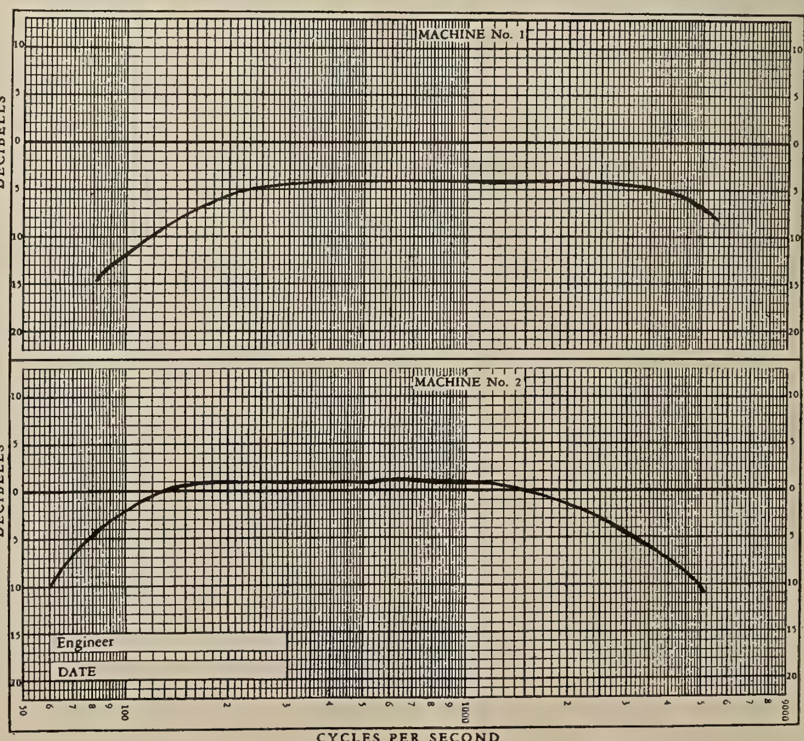


Figure 3

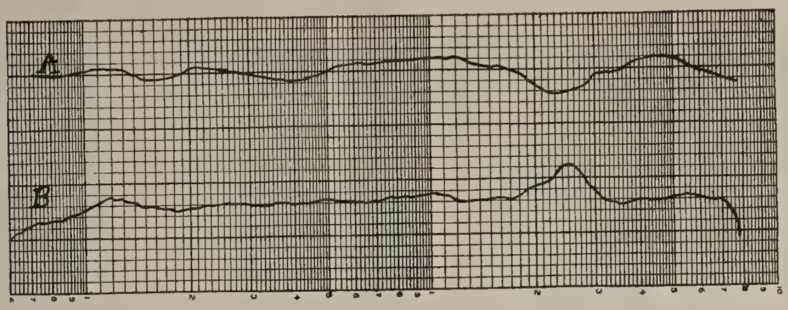


Figure 4

cycle line, and at 150 is down nearly 4 db. At 100, where No. 2 curve is within 3 db. of its 1,000-cycle response, No. 1 is down by 8. This form of trouble—poor response at the *lower* frequencies—is not as usual as is the reverse; in this instance it was found that a coupling condenser, installed as a replacement in the photo-electric cell circuit, was of the wrong value.

It will be noticed that curve No. 2, in Figure 3, is higher throughout than curve No. 1. The difference in 1,000-cycle response, between the two projectors, is 5 db. This is an undesirable condition, and makes the comparison between the machines less accurate than it otherwise would be. The difference in this instance was not due to any change in the volume setting of the sound system, but to the additive result of a number of small discrepancies—exciting lamp current, B-battery voltage, and the age and condition of the exciting lamps and of the photo-electric cells. In practical operation, that condition causes some small trouble in maintaining level volume when a changeover is made. The attenuators, provided with this system to compensate for such minor differences between projectors, were re-set to bring both machines to the same over-all level of response.

Figure 4 is a sketch—not an actual curve—showing the effect of adding an "equalizer" to a sound system to compensate for some deficiency in another portion of the apparatus. Assume curve B to represent the response of a disc reproducer. This particular type of reproducer has an unusually loud response around 2,500 cycles, as shown by the peak in its curve. A is an "equalizer," an arrangement of resistances, condensers or choke-coils, so designed that it offers usual resistance to the passage of 2,500 cycle current. When the equalizer is connected in the disc circuit, the 2,500-cycle dip in its curve balances the peak in the reproducer curve, and the result is to bring down the level of sound at that frequency to give an over-all curve that is level throughout.

The value and use of curves should be reasonably clear to the reader as a result of the practical examples given in this series of articles. It has been shown that the graph is capable of carrying a very large amount of definite information in a very small space, all of which is instantly accessible by a mere reference to the meaning of the cross-lines, as shown by the figures and other information printed, usually, around the edges of the chart. All of this information is presented in pictorial form, which not only makes the strongest impression upon the average mind but also lends itself to quick and easy comparisons.

Consider how much more readily the curves in Figure 3 can be compared with each other than can the same information as compiled in the form of parallel columns of numbers. If numbers were used, comparisons would be relatively difficult and confusing.

The curve has still another advantage—that of "interpolation." The curve of Figure 1 and the numbers in Table A represent the same facts. But interpolation is far more difficult in the case of the table. By interpolation is meant this: the table shows that sound at 90 cycles has a volume of minus 4.75; at 100 cycles, a volume of minus 4. Then, what is the volume at 95 cycles? Will it be half-way between —4 and —4.75—that is, 4.375? Not at all. The volume at 60 is —10, and at 80 is —6, but at 70, half-way between, the level is not half-way between 10 and 6, which would be 8. At 70 cycles the volume in decibels is — 7.5.

Interpolation is often very difficult, and many times impossible, when a column of numbers is employed. The curve, however, gives a very nearly accurate interpolation without any trouble at all. The degree of accuracy of interpolation obtainable in the case of a curve depends only upon how carefully and with how much detail that curve is drawn.

AMONG our CONTEMPORARIES

Gleanings from the public, trade and craft press of opinion on current topics of particular interest to the projectionist as a craftsman and a labor man.

UNION RECEIVERSHIP HIT

AFTER the monstrous usurpation of power by a local court of international union prerogatives, the appellate division, New York courts, reversed the earlier decision, and perhaps halted what promised to be as great an evil as injunction abuse—namely, union receiverships upon flimsy pleas. It is to be hoped that the unanimous, lucid, sane and constructive decision of the appellate division will stand as a warning to flighty judges, to union wreckers, and to clandestine enemies of the labor movement, who apparently hope to ride unions to ruin upon the newest of extra-legal devices.

Union laws are carefully drawn. They are based upon long experience, and have been brought into line with the best principles of jurisprudence. They are generally respected by uninfluenced jurists. It was the burden of the decision of the New York appellate divison that all the tangled affairs of a local union can best be taken over and untangled by the international union, and so ordered.

Effect of Receivership

What a farce the other practice is. A receiver, hostile and inexperienced in union affairs, is appointed at $100 a day to run the union, and to handle strikes and picketing. Any local union thus sentenced is ruined before it starts, by the extra financing incurred and by the inexperienced and hostile manager. The decision of the lower court would make the union the prey of every unscrupulous stool pigeon, agitator and open shop spy who came along.

After all, the important decision of the appellate court has for its background, the question of what is a union. Despite the obnoxious Coronado decision, of the U. S. Supreme Court more than a decade ago, a union is not a business corporation, nor a joint stock company, and should not be subject to the laws controlling these units.—*Journal of Electrical Workers.*

HIGH WAGES ARE BEST

THE full dinner pail was the measure of good wages when William McKinley was President. We want more than full dinenr pails even in these lean years. . . .

We know, among other things, that workers are consumers before they are workers. We know, also, that millions of consumers with money to spend for the good things of life are essential to the prosperity of industry and the welfare of the nation.

Nothing more important to our future well-being has been discovered than the

truth that the prosperity of business depends upon the payment of high wages.

In the days when cartoonists pictured Mark Hanna wearing clothes covered with dollar signs, wages were still counted a tax upon business. The smaller the wage the better the business, according to ideas of that benighted period.

Every intelligent modern business man sees the folly of that thinking. Any business lives on its customers. Workers are customers. The more money customers have to spend, the greater the opportunity of business. A corporation has to give if it expects to receive. . . .

High wages have not involved high labor costs. On the contrary, the output of the American worker has been so large that our labor costs have been very low even when wages were highest. . . .

The directors of large-scale industry, it will be remembered, were very reluctant to lower wages, and the influence of the government was exerted in favor of keeping up rates. What was done was the result of necessity. It was a concession to the emergency. There were some, of course, who welcomed the opportunity to lower labor costs and who unscrupulously pressed their advantage. These, happily, were in the minority so far as they represented industrial opinion.

On the large issue of a national wage policy, however, there has been and there can be little debate. Business will prosper in the United States as the sums paid in wages increase. Low wages mean a small volume of business. High wages make growth possible. The trend must be steadily upward.

The experiences of the most intelligent and the most prosperous American business institutions justify this policy. It is one element in any plan for lasting recovery.—*Colliers.*

GOVERNMENT PRODUCTION AID

INDUSTRY should demand that the government assume responsibility for a plan by which all industries should begin production at normal upon a fixed date, ordering banks to make the necessary credit available, Edward F. McGrady, of Washington, representative of the American Federation of Labor, said recently, before the Catholic Conference on Industrial Problems.

Mr. McGrady's proposal for a governmental order for resumption of normal industrial production followed an attack on the "banking oligarchy which has been bleeding the producers" through control of important industries.

Financial Maladjustment

The corporate organization of industry, Mr. McGrady said, lends itself to financial control which results in 5 per cent of the income receivers getting about 90 per cent of the national income. He spoke of the influence in financial policies exerted by J. P. Morgan & Co., Kuhn, Loeb & Co., Dillon, Reed & Co. and others, by directorates in many banks.

Speaking on the same program was Rev. Dr. John A. Ryan, of the National Catholic Welfare Council, who said:

"We can no longer permit ourselves to postpone remedial action because of the greed or the fears of those who still possess property and incomes.

"The great obstacles are the greed of the few who still enjoy an abundance of comfort, the timidity of the many who have never learned to think courageously because our mechanical civilization has given them the endowment of a slave mind, and the cowardice of those who occupy positions of leadership in politics, business and journalism.

"Upon the latter three classes rests a responsibility that is at once terrifying and of unprecedented urgence."—*United Press.*

FILM EDITING: ITS EFFECT UPON REPRODUCTION

Maurice Pivar

SUPERVISING FILM EDITOR, UNIVERSAL PICTURES CORP. STUDIOS

Film editing is one of the more important processes which exert a strong influence upon reproduction quality. The accompanying article originally was a contribution to the Technical Section of the Academy of Motion Picture Arts & Sciences, and its appearance herein compliments the view that the progressive projectionist should be thoroughly familiar with all processes which go to make up the complete whole—the projected picture.—EDITOR.

II

IT might not be amiss at this point to emphasize the importance of preparation before actual production of the picture. With the advent of recorded sound to the motion picture, the latitude of the editorial department has been minimized to the extent that where originally the possibilities of realigning and re-cutting silent scenes were unlimited, we are now confined within the limits of the dialog. Today a script before it is put into production should be letter perfect because once the dialog has been put upon the film there is no other recourse than to make retakes should this dialog show up poorly on the screen.

Directorial Carelessness

The question of preparation also applies to the timing of scenes. In the old silent days, all a director had to watch for was the position of his actors when changing from one angle to another. He had to make certain that he picked up his actors in the same position when changing his camera angle. Today, he must not only watch the position of his actors but also the dialog that is being spoken while the actor is in a certain particular position.

One of the editor's greatest trials is the carelessness of some directors who overlook the very vital point. To illustrate more clearly: let us assume that the director is shooting a scene where an actor is seated at a desk, and the actor during the scene arises and crosses the room. During this "business" the actor has spoken certain definite lines while he was arising, and certain others while he was walking across the room. Let us further assume that this scene is shot in a long shot.

The director then wishes to shoot the same scene from a closer angle. Quite often, we will find that in shooting this closer angle, the actor did not repeat the lines simultaneously with the action in the long shot. We will probably find that he did not say the first line as he arose from the desk, but as he walks across the room, with the result that the editor is compelled to play the scene in one angle and, even though there may be a decided advantage in going to a closer angle, this cannot be done without showing a break in either the action or the dialog. This, of course, would be bad from an editorial standpoint and could not be allowed.

'Shooting' Technique Varies

The practical director today is one who appreciates thoroughly the limitations of cutting. Directors, however, differ considerably in their methods of shooting. Some directors safeguard themselves by overshooting their picture —that is, they will shoot a scene from many different angles for protection purposes. Other directors, being perhaps more familiar with the cutting of pictures, cut most of their scenes in the camera. Both have their advantages and disadvantages. From the producer's standpoint, overshooting a picture is very expensive; and from the editor's standpoint, undershooting a picture involves untold grief.

A great many obstacles arise as a result of a director trying to cut his picture in the camera. In his effort to economize, the editor at times finds himself in the position of being limited in the cutting of the picture to the manner in which the scenes were actually shot by the director, and unless the director is absolutely perfect in his timing, we find that in trying to connect certain scenes either the action or the sound does not match. It is always a very good expedient for an economical director—in attempting to cut his scenes—to overlap at least part of his dialog and action

(*Continued on page* 25)

NEW STANDARD RELEASE PRINT PROPOSED BY ACADEMY

James J. Finn

Major change involving 1,700-foot maximum and 1,500-foot "average" release print lengths greatly interest projectionist leaders. Other minor changes proposed for new S.R.P. Suggested changes in tentative specifications.

URGENT economic requisites plus the demonstrated inability of a majority of projectionists to maintain the Standard Release Print are the reasons underlying the present activity of the Academy of Motion Picture Arts & Sciences to promulgate and secure the approval of producers and the larger theatre circuits for a new release reel standard. Much intensive effort is now being expended by the Academy to further this project, with a special subcommittee already having submitted its first report and investigations as to projectionist preference under way.

The tentative specifications for the new standard release reel, as submitted by the special subcommittee assigned to work on the matter, call for a maximum reel footage of 1,700 feet, with the "average" release print to be a little less than 1,500 feet. The latter figure falls a trifle short of being twice the length of the present average release print.

The introduction of a new standard release print will result in an immediate large expense to producers and distributors, the bulk of which will go for new shipping cases and alterations in the exchanges. Preliminary surveys indicate, however, that this expense will be amortized by the savings which are expected to be realized within one year after general introduction of the new reel.

"Projectionist Delinquency"

Of particular interest to projectionists is the expressed attitude of the Academy that projectionist delinquency in the matter of maintaining the S.R.P. is a major, if not the most important, reason for the proposed change. Gleaned from the report of the Academy subcommittee assigned to investigate the matter is the following:

". . . The S.R.P. represented the first systematic effort to provide projectionists with an accurate leader. . . . At that time it was hoped that with the leaders made standard and with a national campaign of education, projectionists would stop mutilating the ends of reels, stop scratching on their own personal cues and would make all change-overs perfectly. . . . However, as the amount of sound-on-film increased, projectionists grew careless about keping the prints up to exact length. During the era of musical pictures many reels of less than 500 feet were distributed. . . . First-class theatres adopted the practice of splicing two reels together . . . to give smoother change-overs. Other theatres followed the practice because the projectionists thought it gave a better show or because the longer reels made their work easier.

"In addition, more and more theatres cut down to one projectionist. It is not quite but almost a physical impossibility for one projectionist to run a smooth sound show and keep the reels in the lengths in which they come from the exchange."

The Academy proposes that in future all features be released on a larger reel, and has indicated its preference for a 13½-inch size. Distribution of features on this size reel would, according to the Academy, "effectively and positively stop doubling of features. Projectionists would not attempt to put 3,000 feet and upwards in the projectors and would not have any justification for doing so." It is estimated that the new reel size would be of great advantage in cutting. At present more features are released in eight reels than in any other length. The proportion is about 5 eight-reel features to 4 of seven reels, 3 of nine reels and 1 each of six and ten reels. This estimate is based on a survey of the last twenty releases from the six largest studios.

Fewer Reels, Change-overs

Tentative specifications state that the effect of a 1,700-foot reel (maximum), would be to not quite cut the number of reles in half. In general, features now requiring 8 reels would require 5 reels on the new length; and features now requiring 7 reels would require 4 on the new length, and so on.

This would mean that the cutters would have to find three and four change-overs per feature instead of six, seven or eight as at present. In addition, they would have an average of well over 200 feet leeway in which to find change-over points, as compared with the something over 100 feet average leeway per reel that they now have. In the laboratories a longer reel would cause no difficulties that could not be overcome by minor changes.

In the exchanges the principal cost would be that of buying a large number of new shipping cases. There would not be a complete replacement outlay as the change would require six months or more, but this would be the largest single cost of making the change to the new reel size. Storage vaults in exchanges also would have to be altered over a period of months, but such alterations could be made very cheaply as most vaults are simply bolted iron frames.

Projectionist sentiment relative to this proposed new reel size is sharply divided. Single vs. double reels has long been a

Table A

Proposed Specifications

Under the various headings appear the proposed changes in the original, or 1930, S.R.P.

1. Maximum Footage of Reel: New standard of 1,700-foot maximum, with "average" release print to be about 1,500 feet in length.

2. Reel: A reel 13½ inches in diameter, having 4-inch hubs is favored. Shorts may be distributed on 10-inch reels.

3. Make-Up of Prints: (a) *Protective Leader*—Minimum requirement of 6 feet instead of 4 feet as at present.

(b) *Identification Leader* (*Part Title*)—Reduced from 2 feet to 1 foot, to contain laboratory cues, studio instructions or additional part title.

(c) *Synchronizing Leader* — Eleven frames eliminated from first section. No other change.

(d) *Picture*—No change.

(e) *Motor Cut*—No change.

(f) *Change-Over Cue*—No change.

(g) *Runout Trailer* — Reduced in length from 6 feet to 3 feet.

(h) *Identification Trailer* — Same changes as Identification Leader.

(i) *Protective Trailer*—Same changes as Protective Leader.

controversial subject within projectionist ranks, and it is not unlikely that, unless arrangements for general acceptance of the new standard are entered into between the Academy and projectionist leaders prior to its introduction, considerable difficulty will ensue. In these columns have appeared from time to time opinions of projectionists in practically every section of this country and in Canada, and it is apparent that a majority of these opinions favored the longer reel.

Manpower Considerations

Proponents of the single, or 1,000-foot, standard admittedly are concerned about the probability of the producers using the longer reel to buttress their attempts to reduce manpower through citing the smaller number of change-overs required and a general overall reduction in projection room procedure. Other arguments are advanced by the single-reel adherents, of course, but it is understood that if assurances were forthcoming that the new standard would not be used to effect reductions in manpower, most, if not all, of this opposition would vanish.

The Academy naturally disclaims any interest in the probable effect of the new reel standard on projection room manpower, although their tentative specifications give prominence to the statement that the tendency of "more and more theatres to cut down to one projectionist" was an important consideration in the decision to promulgate a new standard.

It is not unlikely that the tentative Academy specifications will be altered in several respects in order to conform with prevailing opinion and accepted practice in the projection field. Obviously, no new reel standard can possibly enjoy widespread acceptance without the wholehearted support of projectionists, even if a penalty for non-observance should be imposed. Like the present S.R.P., the new reel standard would have to be a cooperative effort, with studios, exchanges and projectionists lending all will disagree with the theory that reel possible support to its maintenance.

First and foremost, all projectionists will disagree with the theory that reel length affects manpower even slightly. Projectionists demand that they be considered something more than mere "film loaders," as is suggested by the statement that a longer reel length is desirable because some theatres have cut down to one man. Recognition of the many varied duties necessary to the proper operation of a projection room is demanded by projectionists, and they insist that reel length is not a vital consideration in this instance.

Projectionists might be willing to lend their aid in establishing a new, and longer, reel standard on the basis that their approval is extended because the longer reel would aid in improving projection. They might say: "Mr. Producer, we favor the longer reel for the same reason that we favor at least two men on each projection shift—because it helps to effect better projection. *But*, Mr. Producer, you can neither ask for nor expect to receive our cooperation for the longer reel standard if, after it is generally introduced, you turn about and use it as an argument in favor of reduced manpower." Thus the projectionist attitude.

Table B

Reel*	Capacity
14-inch	2,000 feet
15-inch	2,300 feet
16-inch	2,700 feet
17-inch	3,050 feet

* *All with 4-inch hubs.*

Technical Aspects

Technically, the tentative specifications leave something to be desired. A maximum of 1,700 feet of film on each reel, the "average" release print to be something less than 1,500 which would be distributed on a 13½-inch reel, would not "effectively and positively stop doubling of features." Practically all theatres at present are equipped with 18-inch magazines, the capacity of which is 3,450 feet of film. On this basis, two reels of "something less than 1,500 feet each," as is proposed in the tentative specifications, could easily, and probably will be, joined in much the same manner as two single reels of "something less than 1,000 feet each" are joined today. Thus, it will be seen that any single release reel which is 1,500 feet or less in length could be doubled and still not exceed the capacity of present magazines.

As for the film-carrying capacity of various reels, all with 4-inch hub, in Table B there appear figures which were compiled as a result of actual tests. The 15-inch reel, now generally regarded as the standard "2,000-foot" length, will safely accommodate 2,300 feet of film.

To effectively stop doubling of features, the new reel would have to run to a maximum of, say, 2,000 feet, with the 'average" release print length to be in no instance less than 1,700 feet, or, if possible, a trifle longer. Only through use of the latter length for a release print would there be obtained any improvement over projection room practice. Those projectionists who, the Academy holds, now insist upon doubling the S.R.P. single-reel lengths of 1,000 feet probably would not hesitate to double two reels of, say, 1,450 each and make a single reel of 2,900 feet, which length could be accommodated in the present standard size magazines.

Thus, any improvement over the present practice of doubling would necessarily demand a change in the tentative Academy specifications for a new reel standard. The longer (2,000 feet maximum and 1,700 feet "average") release print would also have other advantages: (1) the cutting operation would be further simplified through permitting even greater leeway than is expected to result from the tentative specifications; (2) the number of change-overs would be reduced at least by one, with which is tied-in: (3) there would be no need for carrying a small over-run to a fifth reel, with its attendant expense in shipping and inconvenience in projection.

Serious consideration would, of course, have to be given to existing legislation—municipal, state and local union—which bars the use of other than 1,000-foot reels. It seems improbable that legislation tending to offset this regulation could be put through soon enough to permit immediate general introduction of a new reel standard, even if the legislatures to whom appeals would be made were inclined to grant the request. Obviously, any new reel standard which did not operate on a national scale would fall far short of justifying the trouble incident upon its introduction, and the same difficulties which attended the maintenance of the S.R.P. would again be experienced.

As previously stated, the attitude of projectionist leaders in those localities now affected by legislation relative to single reels will be an important factor in the progress of a new reel standard—which brings us back to the previous assertion bearing on the desirability of cooperation between responsible projectionist leaders and Academy representatives. Projection men naturally are interested in protecting the interests of their men; the Academy is interested in the advancement of a new reel standard. Apparently these interests are wholly diverse, but it is not improbable that representatives of each side could easily find some common meeting ground.

Reel length is only one of several changes included in the tentative Academy specifications. The accompanying table (Table A), headed "Tentative Proposed Specifications," explains these contemplated further changes in the S.R.P., all of which probably will meet with the approval of projectionists. Suggested additions to the Academy specifications are: (1) Motor Cue marks might be tried on 2 or 3 frames, instead of on 4 frames, as is proposed, at least for a trial period; (2) Change-overs and Motor Cue markings should be of a different design, and (3) six inches would suffice for an Identification Trailer.

The IP EDITORIAL PAGE

Vol. 4, No. 4 FEBRUARY 1933

Projectionists Out of Industry 'Family' Group

Consideration of technical niceties must give way before the tidal wave of cold hard facts washed up by existing economic conditions. It is impossible to sustain a workingman's interest in craftsmanship in the face of conditions which permit of no credit being extended on the score of better craftsmanship. Present conditions within the motion picture industry are a sad commentary on the oft-expressed views of industry leaders that the projectionist is responsible in large measure for the bulk of improvements in equipment design and construction and for the setting-up of correct projection room procedure—accomplishments which have contributed mightily to the marvelous progress of the art of motion pictures.

Projectionists today occupy a place in the industry that is reminiscent of a small boy trying to effect a hitch-hike on an ice wagon. Undoubtedly the industry feels severely the pinch of existing economic conditions, yet it cannot be denied that consideration has been pretty evenly divided among all industry groups—except the projectionists. Mr. Exhibitor today forgets the fine services rendered by the projectionist craft over a long period of years and proceeds to negotiate wages and conditions which virtually reduce the projectionist to the status of an ordinary day-laborer.

There is nothing for projectionists to do but to grin and bear it. Fifty per cent wage cuts and the imposition of unnecessarily long hours may provide temporary relief for Mr. Exhibitor, but the projectionist should not forget the lesson taught by such procedure. This lesson, which should be learned well, is that the projectionist really is considered not as one of the industry family group but as a necessary evil which must be tolerated for lack of something better to do. In the future when a call is issued for "all-industry cooperation" for this, that or the other "worthy project," Mr. Projectionist will do well to hark back to those days early in 1933 when that industry of which he liked to consider himself an integral part demonstrated conclusively that it regarded him as nothing more than a mere "sweater" whose services were to be bought as cheaply as possible.

A New Deal in Store for Local 306

The election of Harry Sherman as president of Local Union 306 marks the passing of an era in labor union ranks—an era of "czars" and grasping, selfish leaders who forgot the basic requirements for the successful conduct of a labor union and proceeded to traffic with the rights of their members with even less discretion than they would exercise in bartering a sack of potatoes. A complacent attitude on the part of the rank and file, in addition to the introduction on a large scale of forces previously almost unknown within labor unions—alliances with corrupt politicians and judges, strong-arm gangster squad, and the misuse of huge sums of money which accrued to unions during the so-called prosperous times—all these things operated to make easy the way of the labor "czars". Times have changed, and the change has brought only headaches to "czars".

Sherman enters upon his duties as head of the largest and most important unit in the Alliance with the best wishes of 33,000 men in this country and in Canada. Carrying a terrifically heavy load, he will have earned the gratitude of union men everywhere if he succeeds in elevating Local 306 to a plane where it rightfully may be considered as representative of the Alliance all over the country.

The New Reel Standard and Manpower

Consciously or not, there exists a tendency on the part of projectionists to associate the introduction of a new, and longer, standard reel with present widespread attempts to effect sharp reductions in manpower. There is no lack of merit in the proposed new reel length, technically speaking, as it undoubtedly will greatly benefit better projection through fewer change-overs, less handling, a smoother show and a closer approach to what is hoped will be an international standard. From our point of view, we can see absolutely no relation between the longer reel standard and projection room manpower, although the new reel admittedly will be used by exhibitors to effect further manpower reductions. If reel length were even remotely related to manpower, then projectionists might properly be considered as mere "film loaders". A shift of "film loaders" would quickly make of a modern projection room something not far removed from a madhouse.

Discretion prompts the acceptance of the new reel standard by projectionists generally—for the same reason that they favor not less than two men on a shift, and that reason is IN THE INTERESTS OF BETTER PROJECTION. Care should be exercised that nobody is given the opportunity to say that the organized craft is blocking progress; but projectionist acceptance of the new reel should be qualified to an extent that might be useful later on. It cannot be denied that in the projectionists' hands lies the power to make a success or failure of the new reel, and for this reason it would be well if industry leaders gave assurance that due consideration would be given the projectionist viewpoint in return for aid extended in maintaining the new standard.

Longer reels will be introduced whether the projectionist likes it or not, but the process of acceptance can be dressed as a gracious gesture by both sides, for having done which considerable future trouble may be avoided.

NEWS and VIEWS

A collection of random thoughts, and some not so random; fact, fancy and opinion pertaining to the projectionist and projection matters. The free-for-all forum.

Good Projection the Same the World Over

EMPHASIZING the truth of the statement that projection is no better on Broadway, in New York, or in the Loop, Chicago, than it is in even the smallest town in the country which benefits through an alive and alert projection staff is the following excerpt from a recent issue of *Variety*:

Smart work of one manager gave a tie into Radio City. House is in a small town where they feel their importance. Manager got hold of some roto sections of the New York newspapers showing the new Radio City theatres and made a large lobby display. In the center was a large card lettered: "The chief difference between this multi-million enterprise and this theatre is the matter of seating capacity. We have the same sound and projection and get the same pictures."

Made the customers realize that the small-towners no longer have to take the number two or three companies. And somehow it seemed to give some distinction to the house.

Mr. Joe Hornstein will just dote on the foregoing because it lends credence to his argument, published herein last month, that good projection today is dependent upon the initative displayed by Mr. Projectionist in keeping abreast of the times and by devoting the necessary time to keeping his equipment in order.

Utica, N. Y., to the Fore as a Progressive Unit

FROM Glenn H. Humphrey, Business Representative of Local 337, Utica, N. Y., comes the following commentary relative to the report of the Health and Safety Committee of the Projection Advisory Council, published in our November, 1932, issue:

"Editor,

INTERNATIONAL PROJECTIONIST.

Sir: . . . Will you kindly make a correction in any reprints you may make of the report of the Health and Safety Committee of the Projection Advisory Council? This report credits Albany, N. Y., with a safety ordinance requiring a man for each projector operated. As much as I regret having to 'steal' any credit from the Albany local, in the interests of accuracy I shall have to claim the credit for this job for my own city. The ordinance mentioned in this report was prepared and presented for the Utica local by me last August, and the same month saw its approval by the Utica Common Council, effective immediately."

Mr. Humphrey, who also is Secretary-Treasurer of I.A. District No. 10, encloses in his letter a copy of the ordinance in question, pnblication of which is made herewith in the hope that it may prove of some benefit to other I.A. units. The ordinance:

A GENERAL ORDINANCE OF THE CITY OF UTICA RELATING TO THE SAFEGUARDING OF THE PUBLIC IN ASSEMBLAGES AND OTHER PUBLIC PLACES WHERE MOTION PICTURE MACHINES ARE USED FOR THE PURPOSE OF PROJECTING MOTION PICTURES.

BE IT ORDAINED: By the Common Council of the City of Utica, as follows:

SECTION 1. In all theatres, places of amusements, and other public places where motion picture machines are used for the projection of sound motion pictures, there shall be not less than one operator of not less than 21 years of age on duty for each projection machine used or operated.

Penalties Imposed

SECTION 2. Each operator of such machines shall be experienced in the operation of such machines and shall, if requested, submit to an examination by two examiners appointed by the Mayor of the City of Utica, who shall be qualified, experienced theatre projectionists of at least five years' experience. Said examiners, appointed by the Mayor, shall serve without compensation.

SECTION 3. It shall be unlawful for any owner, lesee, manager, corporation or association having in charge such theatre, place of amusement, or other public place where motion picture machines are used or operated, to permit any one man to operate more than one such machine during any one performance.

SECTION 4. Any person, firm or corporation, having violated any of the provisions of this ordinance shall, upon conviction, thereof, be punished by a fine of not less than $25.00 or more than $100.00 for the first offense and in default of payment thereof, by imprisonment for a period of not more than six months; and for a second conviction by a fine of not less than $100.00 nor more than $200.00. Each day such violation exists shall constitute a separate offense, and a conviction under this ordinance shall revoke any license issued to such theatre, and no license shall be issued for a period of three months thereafter.

SECTION 5. This ordinance shall take effect immediately.

No Great Advance in Television Recently

OUR irrepressible contemporary *Variety*, continues to publish fanciful stories about the imminence of television, with the new Radio City in New York stated as being the hub around which nationwide television programs will shortly revolve. Not a few motion picture exhibitors have been scared plenty by these stories, and many projectionists pricked up their ears in response to stories of how their craft would be washed away practically overnight.

As has often been stated in these columns, television has made rapid progress within the past couple years, and it is not unlikely that were it not for unsettled economic conditions a least double the number of present programs would now be etherized. That "television is just around the corner," however, still is the same old bunk we have always said it was. The New York outlet of the Columbia Broadcasting Company recently discontinued its television station.

Television still is on the way to the home, but it looks as though it will require at least five years to make sufficient headway to cause picture houses any great alarm.

SUPREME COURT REFUSES WRIT IN PICKETING CASE

Interference in a clash between Local Union 306 (N. Y. City) and Empire State, dual organization, was refused by the Supreme Court of the U.S. in a closely written order recently. The case attracted widespread attention in labor circles. Three Brooklyn theatres charged that picketing by Local Union 306 damaged their business, and that the I.A. Local sought only to drive out Empire State Union "to gain a monopoly of labor in those particular theatres and in the entire industry in the city of New York."

An injunction against picketing operations by Local 306 was granted by the New York Supreme Court, but the Court of Appeals reversed this finding, whereupon the theatres asked for a writ of certiorari (a writ to call up records for review or relief), which the U. S. Supreme Court denied.

JACK CONWAY NAMED GENERAL MANAGER FOR NORIS CO.

The Noris Carbon Company, with headquarters in New York City, announces the appointment of Mr. Jack Conway as general sales manager. Mr. Conway is well known to the industry through his association with Warner Brothers and with Paramount, his work for both companies having been national in scope. Mr. Conway, a graduate mechanical engineer, is now making an extended trip throughout the country in the interests of wider distribution of Noris products.

WIRED HOUSES IN SPAIN

Approximately 450 theatres in Spain were wired for the reproduction of sound films as of November 1, 1932, out of a total of slightly more than 2,000. The potential total of wired houses, especially unless considerable economic improvement occurs in the country and some solution can be found to give exhibitors product with greater fan appeal, is fixed by one good authority at about 600, with about 50 of these additional 250 possibilities considered good American equipfilms as of November 1, 1932, out of a ment prospects, the balance being divided among foreign firms.

A "LOW-HUM" A. C. SOUND PICTURE TUBE

J. O. McNally

MEMBER OF THE TECHNICAL STAFF, BELL TELEPHONE LABORATORIES

Supplementing that data which appeared in the October, 1932, issue of I.P. under the heading "The W.E. 262-A 'Heater-Type' A.C. Vacuum Tube" is the accompanying article by Mr. McMally. The previous presentation cited only the highlights of this new tube development, further detailed information concerning which is included herein.—EDITOR.

WHEN the filament of a vacuum tube carries an alternating current, disturbance currents of the frequencies of the power supply and its harmonics are found in the plate circuit. In voice frequency amplifiers, with sufficient gain following a vacuum tube so operated, these disturbance currents produce an undesirable or even intolerable hum in the amplifier output.

In tubes where the electron emission is obtained directly from the filament these currents are so great that such tubes can be employed only in amplifiers giving very low gains. Tubes with indirectly heated, or equipotential type, cathodes may be employed for certain radio receiver and general amplifier uses, although they cannot be employed in the early stages of high-gain amplifiers. To provide for the need of an all a-c operated audio-frequency amplifier of high gain, such as are used in public address and announceing systems, sound picture projection, and speech input equipment for radio broadcasting, Bell Laboratories have developed a low-hum tube known as the Western Electric No. 262-A vacuum tube.

Study of Disturbances

Before undertaking the direct development of a low-hum tube, it was necessary to study the various ways by which disturbances enter the plate circuit, and to evaluate the contributions from each source. Equipment was assembled with which it was possible to measure separately the disturbance currents of different frequencies. Output currents as much as 120 db. below one milliampere, or .001 microampere, could be measured with satisfactory accuracy.

With this measuring equipment available, numerous experimental tubes of the indirectly-heated cathode type were made and tested. From the results it was found that disturbance currents are introduced into the plate circuit in three ways: through the electric field due to the potential of the heater, through the magnetic field due to the current flowing through the heater, and through leakage current flowing through the resistance and capacitance between heater and grid, and heater and plate. Disturbances introduced through induction between parts of the circuit external to the tube are not considered because they are not a part of the tube problem.

The electric field due to the potential of the cathode heater acts on the plate current in a manner similar to that of the field of the grid. Since the electric field due to the filament varies with the frequency of the heater supply, a corresponding disturbance current is introduced into the plate circuit.

Effect of Shielding

The space between cathode and plate in any directly heated cathode tube is partially shielded from the electric field of the heater by the cathode cylinder. Below the cathode cylinder, however, there is an unshielded section of heater conductor. Experimental tubes were made, therefore, in which various forms of shielding were applied to this lower section. It was found that commercially practical amounts of shielding would reduce the disturbance from this source by very appreciable amounts. In some of the experimental tubes the disturbance current produced by the electric field in shielded tubes was only about a hundredth of that from similar tubes not shielded.

FIGURE 1
Assembled 262-A tube without bulb and with part of plate cut away to show the grid construction

The shield employed in the 262-A tube may be seen in Figure 1. It is in the form a flattened bell covering the section of the heater wires below the cathode cylinder, and is supported by two short mount wires projecting upward from the glass press. Although not in contact with the cathode cylinder, it is connected to it electrically by a small wire.

Plate Disturbance Component

A component of the disturbance current in the plate circuit arises from a deflection of the electron stream from cathode to plate—and a consequent reduction in current—by the magnetic field produced by current flowing in the heater conductor. These reductions in plate current occur twice for every cycle of heating current, and thus produce a double frequency component—120 cycle for the usual 60 cycle supply—in the output. If the two reductions of one cycle of heater current are unequal, a fundamental, or 60 cycle component, is present. The level of such a fundamental output is generally less than that of the second harmonic, and because the human ear is 18 or 20 db. less sensitive at 60 cycles than at 120, the disturbance of fundamental frequency due to the magnetic field usually is relatively unimportant.

In the 262-A tube the effects of the magnetic field of the heater have been reduced by employing a filament of comparatively high voltage, and thus low current, and by arranging it in a closely spaced "U" so that the field due to the current passing up one side of the "U" partially counteracts that due to the current flowing down the other side. The heater conductor is wound in a spiral and then threaded up and back through two longitudinal holes in a small ceramic cylinder. The two holes are made as close together as is mechanically possible so that the neutralization of the field due to current in one leg by that due to current in the other will be as great as possible.

This ceramic cylinder is mounted with-

CHARACTERISTICS

of Western Electric 262-A vacuum tube —a three element tube having an indirectly heated cathode which permits operation of the heater element directly on alternating current.

Rating

Normal Filament Voltage	10 v. AC or DC
Heater Current	0.29 to 0.35 amp.
Average Heater Current	0.32 amp.
Maximum Plate Voltage	180 volts
Grid Voltage	—4.5 volts
Average Plate Current	3.0 milliamperes
Amplification Factor	15
Plate Resistance	16,000 ohms

Dimensions

Maximum Diameter	1-13/16″
Maximum Length	5¼″

in the nickel cathode which is coated with the thermionically active material. The heater is operated at ten volts and .32 amperes, appreciably less current than is normally used for tubes of this class, and the combined effect of the reduction in current and the arrangement of the filament is to minimize the disturbance current due to magnetic fields.

The third form of disturbance current occurs because of the conductance and capacitance between heater and grid, and heater and plate. The effect may be better understood by reference to Figure 2, where the resistance and capacity between heater and grid, and heater and plate are shown in dotted lines. The heater voltage causes a current to flow through the impedance Zg, of the grid circuit, and through the capacity C_1 and resistance r_1 in parallel, back to the other side of the heater. The voltage drop across Zg due to this current appears on the grid of the tube and produces a corresponding current in the plate circuit. In a similar way the resistance and capacity between the heater and plate are responsible for a disturbance circuit entering the plate circuit directly.

Correctives Applied

In the actual operation of these tubes, the cathode—instead of being connected to one end of the heater winding —is connected effectively to the midpoint. Under these conditions capacities and resistance exist between both ends of the heater, and the grid and plate, but the action is essentially the same.

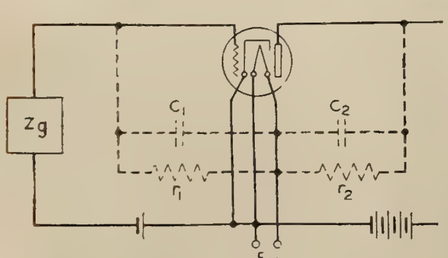


FIGURE 2

Possible disturbance currents in a vacuum tube flow from the heater to plate and grid through the interelectrode capacitance and conductance

To reduce the disturbance currents introduced in this manner, the grid-heater conductance and capacitance has been made lower than for the usual indirectly heated tubes. This reduction has been brought about by supporting the grid between two lavite blocks, evident in Figure 1, and in making connection to the grid through the top of the bulb. In this way both the capacity and conductance between heater and grid leads, usually existing in the common glass supporting press, have been eliminated. The only effective leakage path over glass in the new tube is down the stem and over the entire length of the bulb. This resistance is held greater than 100,000 megohms, and the grid to heater capacity is only about a thousandth of that of the more usual types of indirectly heated cathode tubes. Such values permit the use of resistances of several megohms in the grid circuit without materially increasing the disturbance output.

Other Noise Sources

Plate-to-heater capacities are not sufficiently large to contribute materially to the disturbance outputs, and insulation leakage between plate and heater sufficient to cause appreciable current is prevented by the electrostatic shield already described. This shield bells out over the glass press where the heater leads enter it, and prevents the deposition of material vaporized from the hot surface of the cathode. It is this deposited material that usually forms the conducting path between plate and heater support wires.

FIGURE 3

The W. E. 262-A vacuum tube

In addition to the disturbance currents discussed here, there are certain low level sources of noise, such as the shot effect, and the thermal noises due to the resistances. The level of these unavoidable disturbances forms a natural lower limit by which other disturbances may be judged. Measurements made of disturbance currents in the 262-A tube due to these causes show them to be from 118 to 127 db. below 1 milliampere for the shot effect, and about 105 db. for the thermal noise with 2.0 megohms in the grid circuit.

Disturbance currents in the 262-A tube due to the alternating current supply of the heater are somewhat greater than the shot effect and slightly less than the thermal noise. They have thus been reduced until they no longer exist as factors limiting the application of the tube.

Science Forum

THE STROBOSCOPE—WHAT AND HOW

(Courtesy, General Radio Company)

The quickness of the hand deceives the eye. But the eye knows a trick or two, and aided by ingenious mechanisms, it is not deceived by the gryations of machinery at far higher speeds than the trickster's hand achieves. Hence the stroboscope.

THE stroboscope consists fundamentally of a device which permits intermittent observations, either visual or photographic, of a moving object in such a manner as to reduce the speed of, or stop, the motion. The slow-motion picture is a familiar example of the interesting and profitable information which may be derived from a leisurely study of events which necessarily take place at a a high rate of speed. The tennis player cannot slow the championship stroke to accommodate the laggard eye of the novice, but the camera can, and the motion picture camera is a stroboscope, but not all cameras are stroboscopes.

The camera shutter, operating at high speed, chops up the action into a number of small elements, so short that movement is not apparent in any one. The film can then be projected at normal speed with results that are instructive, or even backward with results that are amusing. The function of the shutter is to exclude light from the film except for brief flashes. It seems reasonable that the same result can be obtained by shutting off the light from the object, except for brief flashes.

Obviously, this type of stroboscope is well adapted for visual observations. Photography must still be used, if a nonrepeated event is viewed, to store the elementary views and to release them later

at a rate that the eye and mind can follow.

Consider, however, an indefatigable tennis player who repeats his stroke, identically, one thousand times a minute in a darkened room. If the light be flashed on him at a constant rate, exactly equal to his stroking rate, he will appear as though motionless under continuous illumination. If the flash speed be slightly slower than his stroking rate, his arm will be illuminated a little farther along in the stroke each time the light flashes and, as the eye retains the image between flashes, the madly stroking player will seem leisurely, and a single stroke can be spread over a minute if desired.

Humans, tennis playing or otherwise, cannot repeat uniform cycles at any such speed. Machines can, and wherever complicated machines are designed, built, or used, the ability to watch their operation in slow motion without photography is a boom.

Varied Applications

The stroboscope permits stopping the motion of the machine (visually), for examination of machine or product at any part of its operating cycle while the grommets flow into the hoppers at undiminished speed. Or, perhaps, a squeaking clutch, a vibrating shaft, or a chattering valve spring stands between a new model and a waiting public—which will not wait long. A slow-motion study will show the trouble, or the primary motion may be stopped and the vibrating member made as conspicuous as a mosquito-brushing hand at formal guard mount.

Sometimes the transient movement or vibration takes place at too high a speed for the eye even with the primary motion stopped. Here photography is restored to for a second slowing down of the transient.

Operating Requisites

A little consideration of what is being done by the stroboscope is sufficient to set up the requirements of a satisfactory one. An accurate means of timing the flash and a prompt and accurate response to the flash control are essential, otherwise the object will be viewed at irregular intervals, and vibrations not present in the object viewed will be introduced.

The flash must be of extremely short duration. Otherwise appreciable motion will take place during illumination, and blurring of detail will result. The light must be brilliant. Otherwise the room must be made entirely dark, and details will not be seen clearly.

ARTIFICIAL LIGHTING HELD BETTER FOR SEEING

ARTIFICIAL lighting is actually better than daylight on the basis of good seeing conditions, according to Westinghouse engineers. In factories and offices particularly, the advantages of artificial light come to the fore. During the day, sunlight changes in color, direction, and intensity, resulting in conditions that produce a strain on worker's eyes. Under similar applications, artificial light remains constant. Because of this difference, lighting engineers have been advocating artificial in preference to natural lighting for a number of years. Already a factory has been constructed without windows, and several offices built after the design.

It is common knowledge that direct sunlight is too intense for comfortable reading. The same is true in painting, hence the reason artists and photographers prefer "north light," the reflection from the north sky. It is indirect and diffused. It is possible with modern lighting equipment to control artificial light so that it simulates "north" light. The reflection breaks up the particles of light and makes soft illumination, protecting eyesight.

NEUTRONS AS ELEMENTARY UNITS OF MATTER

NEUTRONS are elementary particles of matter and not combinations of electrons and protons as has been hitherto thought, experiments conducted at Yale University indicate, Dr. Franz N. D. Kurie, Sterling Research Fellow, announced recently.

The neutron, whose presence was suspected by physicists for many years, was not discovered until a year ago by Dr. James Chadwick, working in the Cavendish Laboratory at Cambridge, England. The difficulty lay in the fact that the neutron does not carry an electrical charge; hence it can pass through various materials without affecting its particles and without leaving a trail, as do electrons or protons when they are shot through a medium. This led to the assumption that the neutron must be a combination of an electron and a proton bound together, the electrical charge thus being neutralized.

Two Views of Neutron

Two views of the neutron are held: That it is either like a dumbbell, with a positive charge and a negative charge, separated by a small distance so that their effects are neutralized, or it is like an onion, with a small sphere of one kind of electricity surrounded by a layer of the other kind, so that again the charge is neutralized.

Dr. Kurie's experiments with neutrons do not conform either of these theories. He concludes that the neutron is not built according to either of the accepted models. His experiments indicate that the neutron is an elementary particle of matter on a par with the electron and proton, possessing its own individuality.

THE SUBTLE BACILLUS

"From Whom Did He Get It? To Whom Did He Give It?"

A. J. Schaeffer

Published as a gesture of thanks on the part of projectionists everywhere to the National Tuberculosis Association in recognition of the latter's Early Diagnosis Campaign which opens on April 1

NOT so many years ago smallpox marks were so common that the person who did not have them was almost a curiosity, diphtheria and typhoid snatched hundreds from the bosoms of of their families, and cholera and the bubonic plague were a recurring feature of community life. Deadly as these scourges were, they had one thing in common—the symptoms of each were recognizable very shortly after the onset of the disease and the victory or defeat of the ever-threatening Reaper was decided in a few days. Today medical science knows not only how to battle such enemies successfully but has even developed means to prevent most of them from ever beginning.

The fantastic realm of microbes has other methods of striking at mankind, however. Among its most subtle weapons is the disease, tuberculosis. Tuberculosis, like all affections, has its own peculiar symptons, but unlike those of other ailments they are not usually recognizable until the disease has made considerable headway.

Nor is its course determined in a week. It frequently demands years of treatment during which the patient must remain in bed. So subtly do tubercle bacilli work that a whole family can become infected from a single member before he shows even the first symptom of illness. Obviously the only sensible step to take when a case of tuberculosis is discovered is to have every member of the family examined to make sure no one else has it. It is especially important that children be examined, and for this purpose a good doctor will use the tuberculin test and, if necessary, the X-ray.

A Family Problem

Why should all members of a family be examined when a case of tuberculosis is discovered? The reason lies in the fact that tuberculosis is not an overnight disease. Modern knowledge tells us that practically every person has the germs of tuberculosis—tubercle bacilli—in his body, and that these bacilli were acquired in small doses usually during early childhood. If the youthful body is strong enough to withstand these small doses of infection the bacilli remain quietly in the body like a sleeping dog, waiting for an opportunity to crash through the delicate defenses.

That opportunity usually comes during the teen age, when the body is run down.

(Contiued on page 26)

Review of FUNDAMENTALS OF SOUND

The probability that projectionists will shortly extend their activities to include the servicing of sound picture equipment has generated renewed interest in the fundamentals of sound recording and reproduction. Each month in this department will appear material which will serve this interest.

THERE are various definitions of sound. Therefore, at the start it is well to have an understanding as to the definition of the word as used in this and in the succeeding information presented. Sound can be considered as a series of vibrations of the air of such fequency, or pitch, that it is audible to the human ear. Sound is sometimes defined as an audio sensation in the ear. Such a definition requires a person to be located in the vibrating air before sound can exist, and is therefore inconvenient in a discussion of sound reproduction.

PRODUCTION OF SOUND.—Sound is produced when air is set into vibration by any means whatsoever, provided that the frequency of vibration is such that it is audible, but sound is usually produced by some vibrating object which is in contact with the air. If we take a string, such as used on a banjo or similar instrument, stretch it taut between two fairly solid supports a few feet apart, and pluck it, sound is produced which dies down in a fairly short time. When the string is plucked it springs back into position, but due to its weight and speed, it goes beyond its normal position, oscillates back and forth through its normal position, and gradually comes to rest. As the string moves forward it pushes air before it and compresses it; also, air rushes in to fill the space left behind the moving string. In this way the air is set into vibration. Since air is an elastic medium, the disturbed portion transmits its motion to the surrounding air so that the disturbance is propagated in all directions from the source of disturbance.

If the string is connected in some way to a diaphragm, such as the stretched drumhead of a banjo, the motion is transmitted to the drum. The drum, having a large area exposed to the air, sets a greater volume of air in motion, and a much louder sound is produced.

If a light piston several inches in diameter, surrounded by a suitable baffle board several feet across, is set in rapid oscillating motion (vibration), by some external means, sound is produced. The air in front of the piston is compressed when it is driven forward, and the surrounding air expands to fill up the space left by the retreating piston when it is drawn back. Thus we have a series of compressions and rarefactions (expansions), of the air as the piston is driven back and forth. Due to the elasticity of air, these areas of compression and rarefaction do not remain stationary but move outward in all directions. (See Figure 1).

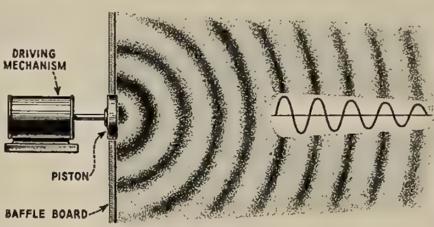


Figure 1

PROPAGATION OF SOUND.—If we could measure the atmospheric pressure at many points along a line in the direction in which the sound is moving, we would find that the pressure along the line at any one instant varied in a manner similar to that shown by the wavy line of Figure 1; or, if we set up a pressure gauge at one point and could catch its variations, we would find that pressure at regular intervals and in equal amounts above and below the average atmospheric pressure. Of course, we could not actually see the variations of the gauge because of the high rate at which they occur.

We can see wave motion in water, however, which is very similar to sound waves, with the exception that water waves travel on a plane surface, while sound waves travel in all directions. We are all fairly well familiar with what happens when a pebble is dropped into a still pool. Starting at the point where the pebble is dropped, waves travel outward in concentric circles, becoming lower and lower as they get farther from the starting point, until they are so small as not to be perceptable, or until they strike some obstructing object. If the pond is small, it will be noticed that the waves which strike the shore will be reflected back. If the waves strike a shore that is parallel to the waves, they will be reflected back in expanding circles. If the waves strike the shore at an angle they will be reflected at an equal angle. (See Figure 2.)

If the waves strike a concave (hollow), shore line, the reflected waves will tend to converge (focus), to a point. (See Figure 3.) The solid lines show the direction of the original waves, and the dotted lines show the direction and focusing of the reflected waves. Focusing of waves results in their reinforcement, which may cause them to build up to considerable proportion at one point.

If you can picture the same kind of wave motion in air, with the exception that the air waves expand as concentric spheres instead of circles, you will have a fairly good picture of a sound wave as it travels through the air. Sound waves are reflected in a manner similar to water waves, causing *echo* and *reverberation.* If the sound waves focus at a point, loud and dead spots are produced. These terms will be explained in more detail subsequently.

Wave motion has certain definite characteristics; these characteristics determine the *loudness, frequency* (or pitch), and *tone* of the sound.

LOUDNESS.—Loudness (or *amplitude*), is determined by the amount of difference in pressure between the maximum compression and the maximum rarefaction. This corresponds in water waves to the vertical height of the crest above

(Continued on page 28)

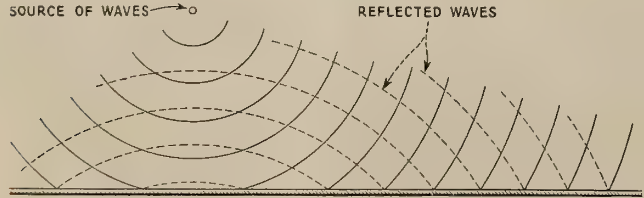


FIGURE 2
Reflection of waves from a plane surface

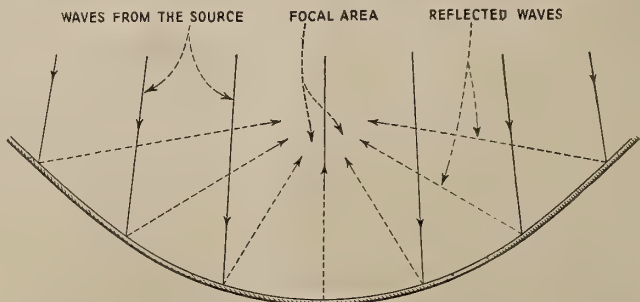


FIGURE 3
Reflection of waves from a curved surface

FILM EDITING PROCESS

(*Continued from page* 16)

when progressing his scene through various angles and to particularly watch that the dialog is timed perfectly with the action in each angle that he shoots.

Requisite Editing Equipment

The actual mechanical features involved in the editing of sound pictures are relatively simple. They involve the use of the synchronizing machine, the Moviola, the splicer and the rewind. All of these devices are easy to operate and require only a minimum amount of experience to attain more or less perfection in their handling.

The synchronizing of film by edge numbers has been explained previously. In addition, each editor is supplied with a synchronizing machine, the purpose of which is to enable him to keep his film in synchronization as he handles it. This device can best be described as a machine which carries anywhere from two to four sets of sprockets. The editor, while handling his film, places both the sound track and the pictures film over these sprockets, keeping the film in synchronization at all times while he is passing it from one reel to another during its handling. Should the film by any chance slip over the sprockets, the editor has the edge numbers by which to guide himself, thus avoiding the necessity of going back to the original start mark in order to check the sound track with the action.

Most editors, however, do not use the synchronizing machine much but prefer the Moviola (film viewing and checking device). The practice is to place the sound track underneath the action, both passing over the same sprocket wheel. Inasmuch as the greater part of the sound film is clear, the light passes through and the cutter is able to handle both films without interfering with his observation of the picture.

Experienced editors require the "syncing" machine mostly for lining up sound effect and musical tracks after the picture has been cut, enabling them to run the action on one set of sprockets, the dialog on the second, the sound effects on the third, and musical or other background noises on the fourth set. In this manner, the editor can run all of his film through the synchronizing machine at one time, matching-in everything in the one operation.

There are two different type patches used in the cutting room,—one which covers the full sprocket and the other covering only the half sprocket. At Universal we find the half sprocket most

satisfactory, because that type seems to pass through the projection machine more readily, not tearing apart after repeated use as does the full sprocket patch.

Systematized Work Necessary

Each editor is, of course, assigned one or two assistants, each of whom should have speed, care and system in the handling of his film. System in the cutting room naturally results in cleanliness. Film at all times should be kept on file in cans and in fire protection cabinets. Fire is a hazard in any part of an organization where film is being handled and the less film that is exposed, the less the hazard. Particular care should be taken to expose as little film as possible and the efficient editor, with the help of an efficient assistant, will have very little film about his room at any one time.

The following mechanical devices really comprise the fittings of a cutting room: metal rewinding tables, each table with one set of re-winders and racks for the filing of small rolls of film—with either artificial or natural light in the background, facing the rack. Steel cabinets for the filing of excess film; combination sound and silent moviolas; film bins and clips for the clipping together of film preliminary to splicing and also the necessary reels required in the handling of the film.

I again want to state that editing involves a great deal of careful and intelligent work. Give an efficient editor the above mentioned equipment, plus one pair of scissors, and no picture is too great a task for him.

Experience a Vital Factor

I have found it a great advantage to surround myself with men who have had a number of years' experience in film editing. In general, the longer the experience, the greater the proficiency. With the handling of each picture an editor learns and experiences situations which perhaps have not confronted him before and in time becomes thoroughly familiar with dramatic, comic and fast tempo situations. Often he is able to create situations in the picture which, from all appearances, the film would not permit.

Summing up, I suggest that a thorough knowledge of film editing is perhaps the best requisite for success in almost any branch of the production end of this business. You will find that directors who have risen from the ranks of editors are the ace directors of the business, the knowledge which they gained as cutters being of untold value to them in their subsequent work.

THE SUBTLE BACILLUS

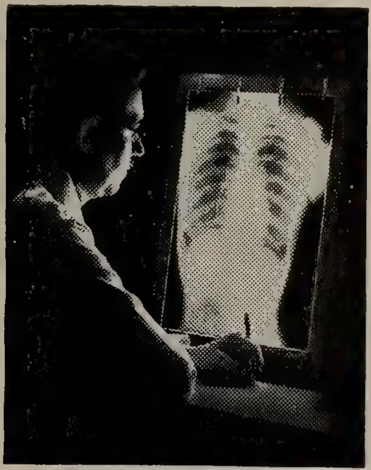
(*Continued from page* 23)

tired, weakened by unusual and prolonged exertion, unwise participation in athletics, overstudy, continuous worry or strain, or by lack of proper food or rest. Then the bacilli silently, insidiously, begin their deadly work. As they overcome the defenses of the body they

multiply enormously, so that the person who has the disease soon begins to throw off bacilli through his mouth and nose in coughing, sneezing, spitting and breathing. In the early stages of the disease no symptoms are usually apparent, and in many cases are never pronounced enough to make the person visit a doctor. Nevertheless, he continues to throw off the tubercle bacilli and thus infects those with whom he is closely associated, whether in his family or at business. Of those persons who thus acquire the disease, one may show active symptoms even before the person who gave it to him.

Group Examination Necessary

It is for this reason that the modern physician is not satisfied merely to place his patient under treatment, but demands that the rest of the patient's family be examined so he may discover whether his patient is the only member who has the disease, and whether he has given it to



The X-Ray is an important Aid in discovering tuberculosis

others or acquired it from one who may be totally unaware that he has it. Only by such procedure can tuberculosis be dethroned from its place as the greatest death-dealing disease between the ages of 15 and 45.

It is to broadcast this information as widely as possible that the 2,084 affiliated tuberculosis associations of the United States conduct each year an educational campaign which they call fittingly an "Early Diagnosis Campaign." This year it will begin April 1, and under the slogan "Examine and Protect All Contacts," will propound the questions, "From whom did he get it? To whom did he give it?"

RCA PORTABLE P.A. SYSTEM HAS MANY IMPROVEMENTS

THE development of a portable "public address" system which provides improved quality of reproduction, simplicity of operation and is housed in a single self-contained carrying case, has been announced by the RCA Victor Company. The new "velocity" ribbon microphone is an intergral part of the new system.

The amplifier is an exceptionally "high gain" unit utilizing Class "B" amplification and providing an output of 20 watts. Two electric-dynamic type loudspeakers are mounted behind grilled openings in the front half of the carrying case, with a 30-ft. extension cable which, together with the 30-ft. cable connected to the microphone, permits of placing the loudspeakers at any desired point from the microphone. The system is provided with volume and tone color controls, a microphone transfer switch, and a special Voice-Music switch for accentuating voice pick-up alone or with a musical background. The whole system is said to be as simple to operate as an ordinary radio receiver advance orders reflect widespread approval of this new equipment.

Sound Fundamentals in Review

(Continued from page 24)

the trough of the wave. (See Figures 4 and 1.)

FREQUENCY.—*Any one of a series of variations, starting at one condition and returning once to the same condition is called a "cycle."* If we should fix our attention at some point on the surface of water in which waves exist, we would notice that at one particular point the water will rise and fall at regular intervals. At the time at which the wave is at its maximum height the water begins to drop, and continues until a trough is formed, when it rises again to its maximum height. Therefore, if we notice all the variations of height which one point on the surface of the water goes through in the formation of a wave, we will have witnessed a "cycle" of wave motion.

The number of cycles a wave goes through in a definite interval of time is called "frequency." Therefore, the number of times the water rises, or falls, at any point in one minute would be called the frequency of the waves per minute, and we would express the frequency as a certain number of cycles per minute.

In sound, the number of waves per minute is large, and it is more convenient to speak of the frequency of sound waves as the number of waves per second, or, more commonly, as the number of cycles per second. Thus, a sound which is produced by 256 waves a second is called a sound of a frequency of 256 cycles. *When speaking of sound, "cycles" always mean "cyles per second."* Considered from the standpoint of traveling waves, frequency is determined by the number of complete waves passing a certain point in one second, and this, of course, is equal to the number of vibrations per second generated at the source.

In the same way, when a racer goes once around the race track and returns to the starting point, he completes a "lap," which, in this case, is just another name for a "cycle."

Music seldom utilizes the full keyboard of the piano, the extremely high notes and extremely low notes being seldom used. Therefore a reproducing device which reproduces all frequencies from 50 to 4,000 cycles would be satisfactory in reproducing musical notes. However, there is another factor which enters into the consideration. This factor has to do with *tone.*

TONE QUALITY.—The terms "quality" or "tone" of sound are used particularly with reference to music. A pure note of a given pitch always sounds the same and the frequency of this note is termed its "fundamental" or "pitch frequency"; but we are all familiar with the fact that notes of the same pitch from two different kinds of instruments do not give the same sound impression. This difference is due to the presence of *overtones,* sometimes called *harmonics.* Let us consider again the case of a taut string which is plucked to set it into vibration. If the string is plucked at its exact center, it will vibrate as a whole and give a very nearly pure note; but if it is plucked at some other point, say one-third of the length from one end, it will vibrate as three parts as well as a whole, and a change of tone will be noticed. If the string is plucked indiscriminately, various tones will be heard, all of the same pitch.

Hollow cavities built into the bodies of the various musical instruments give them their characteristic tones, because the air chambers, called resonance chambers, strengthen overtones of certain frequencies and give a very pronounced tone to the instruments. Other instruments have built into them means of suppressing certain overtones, which help to give them their characteristic sounds.

Character of Overtones

The frequency of an overtone is always some multiple of the pitch frequency; that is, the second overtone has twice the frequency of the pitch note, and the third overtone, three times the frequency, etc. Overtones of twenty times the frequency of the pitch note are present in the sounds of some musical instruments, but overtones of this order are important only when the pitch note is low, because the frequency of the twentieth overtone of even a moderately high note would be beyond the ability of the human ear to detect. Overtones give character and brilliance to music, and their presence in reproduced sound is necessary if naturalness is to be attained. A reproducing device which reproduces frequencies from 50 cycles to 6,000 cycles will cover very well all the notes and overtones necessary for naturalness and distinctiveness.

In singing, the range of notes covered is from 80 to 1,200 cycles, but this range cannot be covered by one person's voice. The frequency of 1,200 cycles does not represent the highest frequency used in ringing, because overtones of several times the frequency of the note are always present in the human voice. The presence of the overtone gives the pleasing quality to songs. This quality of the singing voice is called "*timbre.*" The timbre of the voice transmits the emotions of joy, sadness, etc., from the performer to the audience, and therefore is very important in the enjoyment of vocal music.

WAVE-LENGTH.—Frequency in wave motion is related to wave-length. The

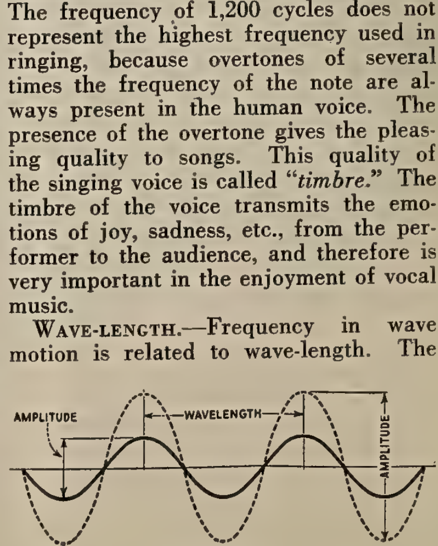


FIGURE 4
Properties of wave motion

wave-length of a water wave is the distance between the crest of one wave and the crest of the next wave. This distance remains the same as long as the wave continues, even though the wave becomes so small as to be hardly perceptible. All waves produced do not have the same wave-length. A small pebble dropped into a pond will produce a wave of short wave-length, but a large stone will produce a wave of correspondingly longer length. In sound the wave-length is dependent upon the frequency of the source. Similarly, in sound the wave-length of a sound wave is the distance between the point of maximum compression of one wave to the point of maximum compression of the next wave. This is illustrated graphically in Figure 2. (See also Figure 1.)

Sound travels at different speeds in different substances, thus it travels at a much higher speed in water and steel than in air. We are interested only in sound traveling in air, where it travels about 1,100 feet a second. An illustration of the fact that time is required for sound to travel from one place to another is shown by a steam whistle at a distance of several hundred yards. If it is observed when blown, it will be noticed that the steam can be seen coming from the whistle a considerable length of time before the sound of the whistle is heard. Sounds of all frequencies, or pitches, travel at the same speed. Therefore, if we divide the speed at which sound travels by the frequency, we will obtain the wave-length of the sound wave.

A knowledge of wave-length is necessary for the proper construction and location of baffle boards and horns, and will be discussed in more detail later on.

Speech.—The sounds of speech are divided into two classes, vowels and consonants. The vowel sounds are used in the pronunciation of the letters "a," "e," "i," "o," "u," and sometimes "y," in the formation of words. These letters are also used in combination to indicate other vowel sounds. The pitch frequencies of the vowel sounds in male voices range from 110 cycles to 140 cycles. For female voices the range is from 230 to 270 cycles. The characteristics frequencies, or overtones of the vowel sounds, however, reach frequencies of 3,300 cycles. So important are these overtones that the pitch frequency can be entirely eliminated without noticeably changing the sound sensation produced on the human ear. The full range of frequencies used in vowel sounds is from 110 cycles to 4,800 cycles.

The pitch frequency of the vowel sounds is produced when air is blown through the vocal cords. The vocal cords are two muscular ledges in the air passage of the throat. When these muscles are taut there is a narrow slit between them, which sets the air passing through into oscillation. The sound produced by the vocal cords is changed by the cavities of the mouth. The shapes of the cavities continuously change as a person speaks, making it possible for him to produce a wide variety of sounds, all of very nearly the same pitch frequency.

Consonant sounds are usually produced without the aid of the vocal cords. Most of these sounds are produced by the lips and teeth, as in the pronunciation of "th," "s," and "f." The range of frequencies covered by consonant sounds is from 200 to 8,000 cycles, but most consonant sounds have frequencies of less than 6,000 cycles.

Hearing.—The actual mechanism of hearing is not very well understood, but certain facts regarding the ability of the ear to register sounds of various frequencies have been determined very accurately. The range of frequencies which the average person can hear is from about 20 cycles to 17,000 cycles, but a comparatively large amount of sound energy is required before the ear can detect sound of extremely low or extremely high frequencies. The ear is most sensitive to frequencies between 500 cycles and 7,000 cycles; also, the ear is most sensitive to changes of pitch and changes of intensity of sound in this same band of frequencies.

MATTER AND ENERGY.—The recording and reproduction of sound involves the use of energy in many forms, and matter in general. Everything with which we come in contact in our daily life is in some way related to energy and matter. Matter is anything which has size, shape and weight, that is, anything capable of occupying space. All matter is believed to consist of small particles, called *molecules*, which are in rapid motion, but travel only through very short distances. Matter is believed to hold its shape due to the mutual attraction of the particles.

There are three classes of matter: *solids, liquids,* and *gases.* In solids the particles are relatively close together and, although the particles are in motion, the motion is of a very orderly nature, and considerable force is required to separate them or change the order of their motion. In liquids the motion of the particles is still very orderly, but the particles slide over each other with less difficulty, and they move at greater speeds than do the particles of solids. In gases the particles move more or less at random, and can be considered as knocking one another around, which give the gas a tendency to expand as pressure is released. The gases of the air are compressed by the weight of the air above, and as we go farther up from the surface of the earth the air is less dense.

Energy is work, anything that arises as the result of work, or anything which can be converted into work. Such a statement is not clear in itself, but it will serve as a starting point for a discussion of energy. For greater clarity, energy can be classified into many different forms, the most common of which are mechanical energy, sound energy, heat energy, electrical energy and chemical energy.

Energy cannot be created or destroyed,

but one form of energy can be converted to other forms. A good example of the conversion of energy from one form to others is the generation and use of electrical energy. The energy of coal is chemical. When coal is burned the chemical energy is transformed to heat energy, which changes water to steam. The steam confined in a boiler builds up a pressure. This steam under pressure is used to drive turbines mechanically coupled to the generators which convert the mechanical energy to electrical energy for distribution.

The electrical energy is converted into various forms as required, such as heat energy to heat flat irons, water heaters, waffle irons, etc.; mechanical energy by electric motors for driving various machines, trains, etc.; light energy for artificial lighting; or into chemical energy for plating metals, charging storage batteries, etc. Since reference will be made to the various forms of energy later on, a brief discussion of the most important forms of energy is entered upon at this point.

Forms of Energy

(*a*) *Electrical Energy.*—The generation of electricity by mechanical means is accepted by all of us as a fact. The ease with which electrical energy can be converted into other forms, and the ease with which it can be transmitted from one place to another, has led to its wide use in our modern times. Electricity plays a very important part in the recording and reproduction of sound pictures, and a fundamental knowledge of the behavior of electricity is necessary for a clear understanding of the process involved. Therefore a brief discussion of the principles of electricity will be given later.

(*b*) *Light Energy.*—Light is anything which affects the sensation of sight. It may seem peculiar to consider light as a form of energy, since it was said that energy was anything which arose from work, or which could be converted into work, or was work itself. It cannot be shown very easily that light is work, but it is easy to see that light may arise as a result of work, as, for example, the red hot sparks that fly from a high-speed saw in cutting steel. In this case a great deal of heat is generated. The heated material emits light, depending on the degree of temperature. Another interesting feature of light is the fact that practically all of the energy which exists on the earth came here as light from the sun. It is this light energy from the sun which produces our winds, and gives us rain and the resultant water power.

These effects are commonly attributed to the heat of the sun's rays, but heat does not travel through a vacuum as evidenced by the "Thermos" bottles in everyday use. Practically no heat arrives at the earth directly from the sun, but is produced at the surface of the earth by the effect of the light rays. This gives us a striking example of the transformation of energy from one form to another. When the light from the sun strikes the earth, the surface of the earth is heated, which in turn, heats the surrounding air.

Heated air is lighter than cold air and rises, thus setting the air in circulation and producing winds. The warm air evaporates water from the surface of the earth (oceans, lakes, rivers, etc.), and rising warm air currents carry the evaporated moisture up with them until they come in contact with the cooler upper layers of air and are cooled. Cold air cannot hold as much water vapor as warm air so that, when the warm air is cooled, the water vapor contained in it condenses and falls as rain. Some of this rain falls on portions of the earth's surface of high elevation, and the energy of the water due to its elevated position is available for turning water wheels for the generation of electric power.

(*c*) *Chemical Energy.*—The chemical energy which a substance has is contained in it by virtue of its chemical composition. It is rather difficult to understand what chemical composition has to do with work, but it is easy to understand that chemical energy can be converted into work. Such a conversion takes place in a gasoline, or oil, or steam engine when the chemical energy of its fuel is converted into work for driving automobiles, motor boats, ships, etc.

(*To be continued*)

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Edited by James J. Finn

March 1933
Vol. 5, No. 1

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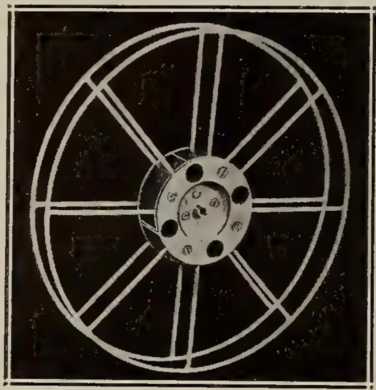

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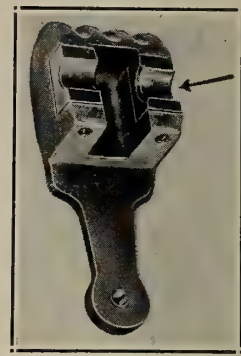

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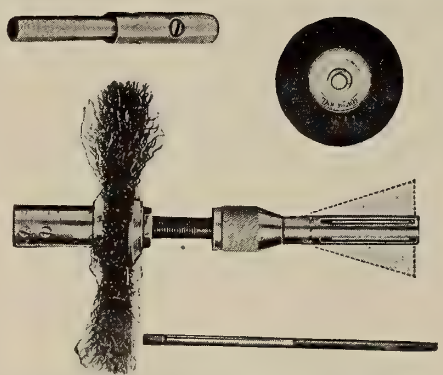

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MONTHLY CHAT

PROJECTIONISTS continue to exhibit a lively interest in the servicing of sound picture equipments, despite the fact that events of the past few weeks have militated against much actual work on the proposition. Wage cutting is the pressing topic of the moment; but there isn't, or shouldn't be, any doubt that the assumption of sound system servicing work by projectionists is the next logical step in the exhibition field. Projectionists themselves can do much to spur activity in this direction by tending strictly to business while in the projection room and exhibiting a proprietary interest in every detail of room operation.

Yes, we've heard the chorus of "It can't be done," even from projectionists; but anybody who thinks that sound equipments can be much longer kept under lock and key is very much mistaken. Mr. Projectionist, go to it!

RIDING high at the moment, and riding the industry hard, are the producer - distributor - exhibitor combinations—combines which to our mind have done more harm to the industry than any other single factor. Recent wage cuts and theatre closings obviously have been effected by common consent among the so-called "industry leaders," whose idea of a smart move is and has been for ten years to be both seller and buyer of film. Where do the independents stand right now?

The point we wish to make is that the time is now ripe for an effective combination between projectionists, through their Unions, and independent exhibitors, with the latter being accorded every consideration by the former. Such a combination, wielding terrific legislative pressure, would bring the "industry leaders" to heel—and quickly. Think it over.

WIDE RANGE may be just a phrase to many; but there is no ducking the implication contained in the announcement by W. E. that it will be unable to fill further orders for Wide Range equipment before July. The campaign for extended frequency range reproducers has been going on quietly but effectively, and marvelously improved sound quality is a certainty in the near future.

One question pops into our mind: Have projectionists kept pace with the constant improvement in equipment and technique? Has time taught them the tricks of efficient sound projection? Everybody answer for himself.

INTERNATIONAL PROJECTIONIST

VOLUME V | NUMBER 1

MARCH 1933

FUNDAMENTALS OF VACUUM TUBE OPERATION

Eugene L. Bruyning, Ph.D.

CHIEF ENGINEER, DUOVAC RADIO TUBE CORPORATION

II

IT was shown in the preceding article of this series that if we placed a resistance in the plate circuit of a vacuum tube, the plate current variations would be translated into voltage variations across this resistance. It is obvious that the voltage developed across such a resistance would be dependent on the value of the resistance, and that maximum voltage can be developed only if an infinite resistance is used.

In order, therefore, to translate the plate current variations due to the grid voltage variations, so large a resistance must be placed in the plate circuit that no current can go through to the tube proper. For this reason, it is impossible to realize the maximum voltage amplification possible with any tube.

The actual voltage amplification of any stage in an amplifying system is dependent, therefore, not only on the amplification factor of the tube but also on the load resistance—that is, the resistance in the plate circuit. Due to the fact that any resistance in the plate circuit affects the current that will flow to the plate of the tube, the resistance of the tube proper must be taken into consideration. The resistance that a tube offers to alternating current is called the *plate resistance*. The voltage amplification is the product of the amplification factor and the load resistance divided by the sum of the plate resistance and the load resistance, thus:

$$\text{Voltage amplification} = \frac{\text{Amplification factor} \times \text{load resistance}}{\text{Plate resistance} + \text{load resistance}}$$

Analyzing this equation, we see, therefore, that the maximum voltage amplification is only realized when the load resistance is infinitely larger than the plate resistance. Let us see in what manner these factors enter into the actual behavior of tubes.

Factors Affecting Behavior

Assume that the load resistance of a certain vacuum tube has become smaller due to some reason—for instance, a short-circuit. The plate resistance of the tube has not changed very much as a result of this "short," so that the ratio of plate resistance to load resistance has become smaller than it was originally. We have seen from the formula that the voltage amplification is dependent upon this ratio, and decreases when the ratio decreases. The voltage amplification, therefore, will become smaller and the sound output will decrease.

Likewise, if the plate resistance of a vacuum tube has increased, for instance, due to the drop of emission in the tube, the ratio is also decreased and the sound output will become smaller. If the sound output of an amplifying system suddenly decreases, the reason is invariably either in the vacuum tube or in the load resistance of the vacuum tube, which is usually a transformer. Both the instances cited thus far are actual defects. There are other possibilities, however, of faulty sound output which are not due to actual defects.

Assume that someone, by clever design, as well as by the use of excellent emitters, or by any other method, obtained a vacuum tube with considerably lower plate resistance than is usually encountered. In this particular type of tube, distortion may result when such a tube is used in an amplifier. The distortion would be caused by overloading, because the

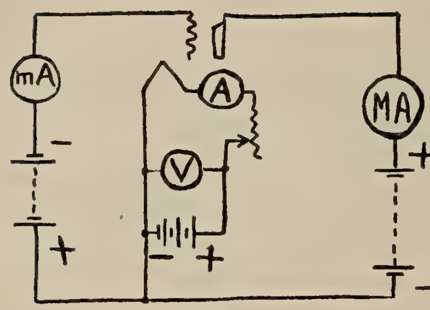

FIGURE 1
Static characteristic measuring circuit

output would be greater than that for which the amplifier was designed. Such a tube can hardly be called defective, yet it would be detrimental to efficient operation.

Mutual Conductance

Wherever a formula is seen that concerns the voltage amplification of a vacuum tube in an amplifying system, there invariably would be found the ratio of amplification factor to plate resistance. So important is this ratio that a specific term was devised for it, namely, *mutual conductance*. The mutual conductance is therefore the quotient of the amplification factor and plate resistance, thus:

$$\text{Mutual conductance} = \frac{\text{Amplification factor}}{\text{Plate resistance}}$$

This characteristic has become the criterion of the merits of a vacuum tube.

In testing vacuum tubes of any particular design, the mutual conductance is invariably measured and high and low limits are set between which these characteristics must fall in order to obtain satisfactory sound output.

Vacuum Tube Testing

Now that we are familiar with the fundamental characteristics of vacuum tubes, we can give some attention to the methods by which these characteristics are determined. Let us begin with the most fundamental characteristics:

Plate Current: The plate current is determined by the use of a D.C. meter in the plate circuit. The test circuit shown in Figure 1 is self-explanatory and allows the measurement of plate current, filament current, grid current, and filament voltage. The proper potentials are applied to the various electrodes in the manner shown, the voltmeter marked "V" is set to the rated filament voltage, and the ammeter marked "A" will then show the filament current.

It is of interest to note at this point that the actual filament current should be measured with the plate and grid disconnected. The plate current will be indicated on the milliammeter marked "MA," while the grid current will be shown on the microammeter marked "mA." Limits are obtainable between which these currents should fall in order to make for satisfactory operation.

Another characteristic which we have not discussed thus far is the emission, or *emissivity* of the tube. The emission is an indication of the emissivity of the cathode and therefore gives an idea of the probable life to be expected. The most common way of testing emission is shown in Figure 2. The grid and the plate of the tube are tied together and through a milliammeter connected to the positive end of a 50-volt battery. The rated voltage is applied to the filament, as shown by the voltmeter "V." The switch "sw" is momentarily depressed and the read-

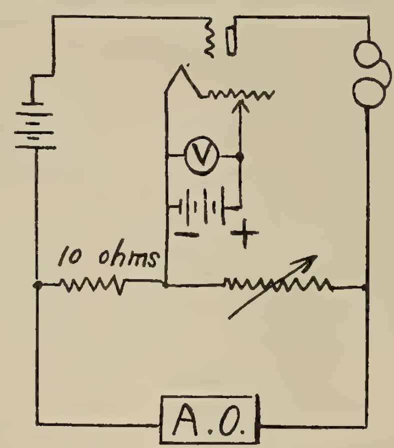

FIGURE 4
Amplification factor bridge circuit

ing on the milliammeter, "MA," denotes the emission of the tube.

All these characteristics are called "static characteristics"; while the amplification constant, the plate resistance and the mutual conductance are usually called "dynamic characteristics".

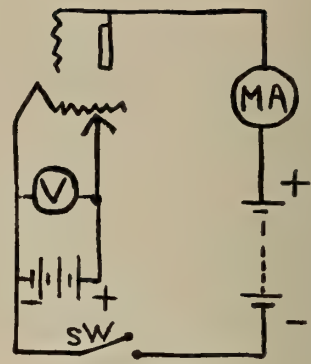

FIGURE 2
Emission test set

We shall now consider the calculation as well as the measurement of the "dynamic characteristics." The *amplification constant* can be calculated from a graph in the following manner:

"Dynamic Characteristics"

Measure the plate current for the rated grid and plate voltage. Now change the grid voltage by a small fraction (say, half a volt), either more positive or more negative, following which the plate current will either increase or decrease. Then, change the plate voltage so that the plate current is again what it was originally. The ratio of the grid voltage change to the plate voltage change is the actual amplification constant — providing, of course, that the grid voltage has been changed only a small amount. In the same manner the amplification constant for various grid and plate voltages can be calculated.

A graph such as is shown in Figure 3 can be obtained if the results are plotted on graph paper. The slope of this curve will give the amplification factor at any operating point.

Direct measurement of the amplification constant may be accomplished by the use of a bridge such as is shown in Figure 4. The rated potentials are applied to the electrodes, while a phone

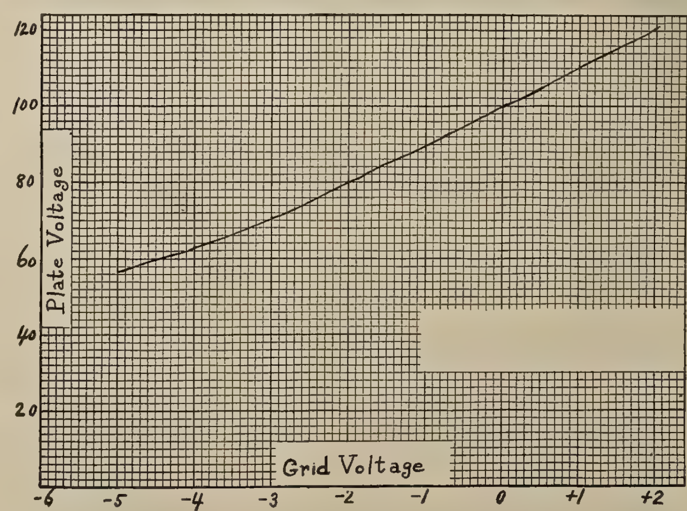

FIGURE 3
Plate voltage vs. grid voltage to obtain definite plate current

is inserted in the plate circuit, a 10-ohm resistance is inserted in the grid circuit, as is shown, and a variable resistance is inserted in the plate circuit. An audio oscillator[1] marked "AO" is connected as indicated. When the audio oscillator is operating, the resistance marked "R" is varied until no note is audible in the phones.

Amplification Factor

The value of the variable resistance divided by 10 is the actual amplification factor. The 10 enters into the calculation by reason of the fact that the value of the grid resistor is ten. [If it were any other value, the plate resistance should be divided by that value.]

The plate resistance is measured by the use of a special bridge the circuit for which is shown in Figure 5. The rated potentials are applied to the electrodes of the tubes, and the various resistances are connected, as shown. The resistance "RA" has a value equal to that obtained in measuring the amplification constant. The resistance "RB" is varied until no note is audible in the earphones. The value of this resistance multiplied by 100 is the actual plate resistance.

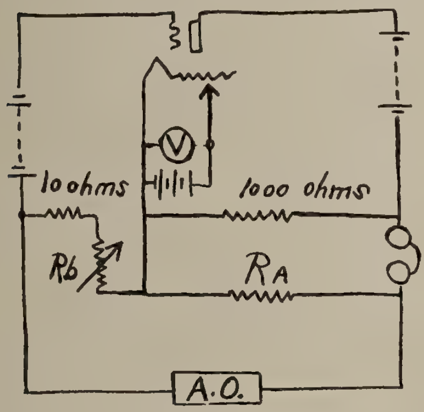

FIGURE 5
Plate resistance bridge

Mutual conductance is obtained simply by dividing the amplification constant by the plate resistance.

Output Tubes

Thus far we have treated vacuum tubes only as pure voltage amplifiers. The tube in the last stage of an amplifying system, however, is not a pure voltage amplifier insofar as it has to deliver actual power to the loudspeaker. The output tube differs from all other vacuum tubes in that an attempt is made to use as high a grid bias as possible and still retain a low plate resistance. In order to obtain low plate resistance with large grid swing, the amplification factor necessarily is low.

Previously we showed that maximum voltage amplification occurs when the ratio of plate resistance to load resistance was as great as possible. In the output tube, however, to obtain *maximum power output* the load resistance must be equal to the plate resistance. To obtain *maximum undistorted power output,* however, the load resistance must be *twice as great as the plate resistance.*

In the next article of this series we shall investigate in detail the undistorted power output of vacuum tubes and discuss more completely the behavior of vacuum tubes in amplifying circuits.

[NOTE: Questions on any phase of vacuum tube design, manufacture or operation are solicited from readers of I. P. and will be answered by Dr. Bruyning in the next issue.]

(To be Continued)

[1]An audio oscillator is designed to produce a steady note of a given frequency and employs an ordinary tuning fork which is constantly actuated by an electromagnet.

PROPER CARE BEST PREVENTIVE OF M-G SET TROUBLES

Observations on "The Maintenance of Motor Generators," by A. C. Schroeder, which appeared in February issue

William H. Haines
ENGINEERING DEPARTMENT, ELECTRIC SPECIALTY COMPANY

THE author has described in detail how to sand-in brushes, but no mention was made of the necessity of carefully removing all sand from the commutator, brushes and brushholders before resuming operation. This is very important to prevent undue wear on brushes and commutator and can be accomplished by carefully wiping the brushes, brushholders and commutator with a clean dry rag after sanding.

Different materials are used in generator brushes and quite different kinds of materials are required for different operating conditions. Low voltage, heavy current machines require brushes with very much lower resistance and larger copper content than machines of high voltage and low current.

It is very necessary to use the proper grade of brushes in each machine and projectionists should be instructed to use only those brushes supplied by the manufacturer of the particular machine they are operating. Failure to do this may cause rapid wear of the brushes or commutator, and may cause unsatisfactory commutation, resulting in sparking and damage to the commutator. Also, brushes of suitable composition contain lubricating material which provides the proper amount of lubrication for the particular combination of brush and commutator being used.

The article covers interestingly how to detect and correct troubles and defects, but I think more stress should be laid on proper care under ordinary operation in order to prevent such troubles from developing.

Grit or dirt of any kind should not be allowed to collect on the commutator or brushholders. It will cause wearing of these parts and also if allowed to collect in quantities may cause grounding or short circuit, destroying the insulation.

Operating Precautions

Lubrication is very important. Generally, projectionists use too much oil, rather than not enough. It is, of course, important to provide sufficient lubrication of the bearings to prevent wearing out of the bearings, but most projectionists put in so much that the oil leaks onto the commutator or brushes. The most common cause of the failure of motors and generators is oil on the brushes causing sparking between commutator and brushes. Also, oil on the commutator or brushes collects dirt, sometimes causing short circuits.

Even when care is used not to apply too much oil, the brushes and commutator should be frequently inspected and frequently wiped clean with a clean, dry rag.

I believe in general that if such instructions as mentioned above are followed, the troubles described in the article would never appear, especially on motor-generators of good design and suitable construction.

NO TROUBLE IN 4 YEARS

The Rialto Theatre, Greenville, Tex., celebrating its fourth anniversary of talking pictures has established what is believed to be a record in operating for four years without a single program interruption because of the sound equipment. The theatre operates with W. E. Sound System.

TWO-MEN vs. ONE-MAN PROJECTION ROOM OPERATION

A Transcript of an Address Delivered Before Legislative Committees of the States of Ohio and Connecticut by

James J. Finn

THERE are three basic reasons why a motion picture projection room should be operated with not less than two men on duty therein. These reasons have nothing whatever to do with considerations of manpower, and are based not on personal prejudice but on sound technical fact. These reasons are:

1. Good Projection
2. Safety Requirements
3. One-man Operation is Inhumane

Before proceeding to discuss these points in detail, I should like to give a brief general description of a projection room, so that you gentlemen may be familiar with the information which will follow.

The showing of a so-called feature motion picture requires not less than two projectors, and in some of the better-class theatres there are three and four projectors. The film-carrying capacity of a projector usually is 2,000 feet, and in no instance does it exceed 3,000 feet. The average feature picture runs to 7,000 feet—sometimes more, sometimes less—but 7,000 feet is the average length.

Film is shipped and should be exhibited in lengths, or reels, of 1,000 feet. On this basis an average feature film, such as is shown in every theatre in this State, would require change-overs, which is the name applied to the action of cutting-in one projector in unbroken continuity as the film nears the end of its run in the other projector. When the change-over is made, the film must be taken from the first projector and rewound. It must also be inspected for tears, and patches must be made before a particular reel of film is again run through the projector. Obviously, such duties require that the projectionist leave the side of the operating projector and, in fact, actually turn has back thereon.

In addition to these duties, the projectionist now bears the added responsibility of the sound reproducing equipment, with its manifold requirements on his attention and its comparatively high voltages. A part of the projectionist's duties is the proper regulation of the volume of sound in the auditorium by means of a fader, so-called, which usually is mounted on the front wall of a projection room.

Extended remarks would develop in detail other duties of the projectionist, but this brief summary will suffice for the present. We now come to consideration of the three major points mentioned previously.

1. GOOD PROJECTION

Good projection is not an automatic process. The motion picture projector is no longer a crude mechanical contrivance but a delicately balanced mechanism—in many respects as delicate a mechanism as a fine watch. Good projection requires constant adjustments by the projectionist to maintain a good picture on the screen, and by a good picture I mean a picture that is in sharp focus, is well-lighted and with the light evenly distributed. I submit, gentlemen, that good projection can only be secured through the constant attention of a competent projectionist who is stationed at the operating side of the projector.

When an exhibitor accepts admission money at the box-office he is in effect entering into a contract with the paying patron to provide the latter with his money's worth. The best picture in the world can only be as good as the quality of projection offered in a given theatre—and no better! Motion pictures have been characterized as a means of escape from reality into a world of illusion, and with this I agree. But, if illusion is to be rudely shattered through inferior projection work—which is almost inevitable with only one projectionist on duty—then the motion picture fails signally of its purpose and it becomes not an escape from reality but a positive irritant—and Mr. Exhibitor has not only failed to keep his bargain but has imposed on his customer to boot. Good projection is not a fancy theory, gentlemen, but the unquestionable right of every person who pays admission into a theatre. A fair exchange is no robbery, so the saying goes; but giving a paying patron poor projection is nothing but robbery.

That exhibitor who accepts money from a patron and does not offer a well-projected picture on his theatre screen is as guilty of robbery as he would be if he dragged his customer up an alleyway and slugged him before robbing him.

There are other aspects of this same topic. A recent inquiry conducted by the International Institute of Cinematography (League of Nations), disclosed the fact that 63% of more than 5,000 persons covered by the survey testified to severe eyestrain when the picture was jumpy or poorly lighted. Also of interest is an opinion by Dr. Park Lewis, of Buffalo, an outstanding authority on the conservation of eyesight. In submitting to leading medical societies the findings of an extensive survey into the effect of motion pictures on the eyes, Dr. Lewis emphatically stated that wherever the equipment and the projection personnel were up to standard, no harm resulted; but improper projection work, with or without defective equipment, invariably induced severe eyestrain

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THE greatest menace to continuation of two-men shifts is the projectionist who midway through a shift gets tired, or suddenly develops a yen for a Bromo Seltzer, or wishes to rest his eyes by reading the current nickel weekly—or some such thing. All of which makes No. 2 man merely an accessory and mitigates the benefits derived from two-men projection room operation. The imposition by Unions of stiff penalties for such idiocies might curb these tendencies.

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and, often, prolonged headache on the part of moviegoers.

Good projection is the right of the people of this State who pay their admissions into motion picture theatres; and good projection can only be had through the constant attention of the projectionist to the projector—an impossibility where only one projectionist is on duty.

2. SAFETY REQUIREMENTS

The inflammability of motion picture film has been demonstrated on innumerable occasions, often with horrible results in the form of loss of life and severe damage to property, not only to the theatre in which a fire occurs but often to whole city blocks. Much has been said concerning non-inflammable film, but there really is no such thing. That film which is known as non-inflammable is really slow-burning film, and is officially described by the National Board of Fire Underwriters as a film which has a higher ignition point and burns only slightly slower than the regular type of motion picture film. I doubt that anyone present would care to be locked in the same room with even 100 feet of so-called non-inflammable film which had been ignited.

Motion picture film is in reality nitro-cellulose and is made from gun-cotton. From gun-cotton there is also made powder, dynamite, T.N.T. and other high-explosives. When film catches fire there is always present the added danger of an explosion, the result of a concentration of nitrogen-oxide gases which, when dense enough, are ignited by the film itself.

Inflammability of Film

The fact that film is highly inflammable and constitutes an ever-present danger (despite the vigorous pooh-poohing of the opposition here today), is borne out by the extraordinary precautions which are taken to insure its safe handling. The film is placed in a metal can and is transported in special film-carrying automobiles. It is highly significant that no common-carrier, as such, will transport film. In the film exchange itself special vaults are utilized for the storage of film, and both its storage and handling are rigidly supervised by the fire authorities. The insurance rate for such storage is extremely high, reflecting the opinion of the insurance companies themselves as to the inflammability of motion picture film.

If there be no great danger of a film fire or explosion, why all these extraordinary precautions? Insurance rates for all motion picture theatres are so high as to constitute *prima facie* evidence of the danger inherent in even a limited supply of motion picture film in one place. Why is this? Probably one of the exhibitors in this room can answer this query.

The presentation of these facts anent the dangers of film-handling are not intended as a scare-all. On the contrary, the record of the motion picture business indicates that when proper precautions are exercised the danger of a film fire or explosion is small. It is only when vigilance is relaxed that film-handling becomes a mighty serious problem.

Who shall say that vigilance is not being sacrificed when only one projectionist, burdened down with diverse duties, is available in a theatre projection room?

Modern projection utilizes the carbon arc. I quote here a passage from the most recent Carbon Handbook of the National Carbon Company: "The carbon arc has the greatest brightness per unit area of any artificial light source known, rivalling that of the sun." I submit, gentlemen, that if the carbon arc is capable of producing a light rivalling that of the sun, it must be productive of intense heat. *It is.*

Aperture Temperatures

Careful tests made by competent workers disclose the following temperatures within the projector lamphouse and, with the various types of arc, at the aperture:

(a) Lamphouse heat—3,000 degrees, F.
(b) High-Intensity Arc (aperture)—1,500 degrees, F.
(c) High-Low Arc (aperture)—1,100 degrees, F.
(d) Low-Intensity Arc (aperture)—800 degrees, F.

These are the three types of projectors in use today, and a majority of theatres use either the High-Intensity or the High-Low arcs.

To save time, we may consider that arc which is productive of the least

S. M. P. E. Projection Committee Opinion Supports Two-Men Room Operation

IN its investigation of the question of two-men vs. one-man projection room operation, the National Research Council, Canadian Government subsidiary, solicited the opinion of the Projection Practice Committee of the Society of Motion Picture Engineers. Appended hereto is the reply of the Committee, published by permission of the Council.

National Research Council
Government Building
Ottawa, Canada.

Gentlemen: . . . We are unable to state authoritatively what may have been the original reasons for employing more than one man on a projection shift; but it is our opinion that these reasons may have been the following:

1. Threading one projector while the second projector still is in motion;
2. The necessity for constant care in the matter of keeping the picture sharply in focus upon the screen and maintaining a uniformly lighted picture;
3. Controlling the sound volume and maintaining the proper level so as to insure maximum entertainment value;
4. Trimming the arcs of projectors and, if used, those of spotlights and effects machines;
5. Watching for breaks in the film;
6. Constant alertness in guarding against fire, and the necessity for instantaneous action in stopping the projector, closing the projector dowser and, subsequently, the projection room ports;
7. Changing over from one projector to another without any noticeable interruption in the show;
8. Rewinding of film reels, with its accompanying duties of inspection of film for loose splices, tears, etc.
9. Splicing of the film;
10. Supervision of the sound and projection equipment and the making of emergency repairs and adjustments;
11. Responding to telephone calls from the manager.

Items 1 through 7 involve the attendance of the projectionist at the operating side of the running projector and simultaneous duties elsewhere. Worthy of special consideration is the fact that personnel are required, for physical reasons, to occasionally leave the projection room, a failure or inability to do which may invite physiological injury.

The foregoing information reflects the consensus of opinion among the members of this committee as adduced at a committee meeting to which your communication was presented.

heat—the Low-Intensity—and ponder the fact that the heat therefrom will quickly burn a hole through a block of wood one inch thick at the same distance removed from the arc as is the film in the projector. Need more be said relative to the more intense heat produced by the other type arcs?

The only thing that prevents every reel of film that passes through the projector from bursting into flame is the rapid motion of the film past the aperture. The film passes the aperture at a speed of 90 feet per minute, or 18 inches a second. The vital consideration, gentlemen, is that this rapid flow of film past the aperture be not interrupted, with what results I need not cite in view of previous statements.

The contention has been advanced here that few film fires occur in each city, in each state, and throughout the country during the course of a year. Yet, the National Board of Fire Underwriters reported recently that an average of five film fires per day are reported to its offices. Figured on a yearly basis, it is evident that some 1,800 film fires occur every year, and that they must be fairly evenly distributed geographically. Judging from the statements made here today anent this State's unblemished record in this respect, one might think that Divine dispensation was operating to protect this State. The figures tell a different story.

It is important, gentlemen, that none of these fires occur in this State with disastrous effects.

Another contention advanced here today is that "only a few frames of film are burned in the average film fire in theatre projection rooms," as it is naively expressed by those who oppose this measure. I am in complete accord with this statement, and therein is the real danger emphasized. Only one frame of film need catch fire to do serious damage. It requires only the image of a single frame of film to be projected on the screen to throw the audience into a panic and cause a rush for the exits. It is this panic, the result of even an inconsequential film fire, that does the trick. Only prompt action by a projectionist stationed at the operating side of the projector can avert such happenings. A projectionist who is busy with rewinding or with the sound equipment or with the many other duties imposed upon him cannot possibly give close attention to the projector mechanism.

Who in this chamber does not recall the theatre fire in Quebec, Canada, only two years ago, in which hundreds of bodies were carried from the ruined theatre to lay in stiff silence upon the pavements? Of course it was not the film fire which occasioned this holacaust; it undoubtedly was caused by the panic which ensued when a greatly enlarged image of a burning film frame was projected upon the screen. But that was enough.

So-Called "Safety" Devices

It has been said here today that the modern projector is equipped with every safety device, the result of years of development by the manufacturer of projectors and others. True. But I say emphatically that there is no known safety device which will positively prevent a projector aperture fire—none, absolutely. It is of interest that a widely-advertised safety device which was said to be a positive fire-preventive has failed dismally of its purpose and even now is being ripped out of theatre projection rooms as a hindrance to good projection.

There is only one positive fire-preventive, and that is an alert and conscientious projectionist who is ever watchful in guarding against fire and, should fire break out, to instantly act to check the fire and protect the audience. Such vigilance is impossible with only one man on duty.

The important point is not the number of fires that have occurred in this State, and not the results thereof, but the necessity for preventive measures which will eliminate the probability of fire. Minimizing the number of fires which occur will not serve as a substitute for rigorous insistence upon proper preventive measures. I do not mean to cast the projectionist in the role of a fireman; that is not his function. But I do want to emphasize the necessity for having a projectionist to play the role of Johnny-on-the-spot if and when a fire should occur.

Small-Theatre Opposition

It is significant that the bulk of opposition to this measure comes from the smaller theatres which have ever displayed a penchant for granting

FILM EDITING: ITS EFFECT UPON REPRODUCTION

H. J. McCord

CHIEF EDITOR, WARNER BROTHERS-FIRST NATIONAL STUDIOS

Film editing is one of the more important processes which exert a strong influence upon reproduction quality. The accompanying article originally was a contribution to the Technical Section of the Academy of Motion Picture Arts & Sciences, and its appearance herein compliments the view that the progressive projectionist should be thoroughly familiar with all processes which go to make up the complete whole—the projected picture.—EDITOR.

III

THE film editor, in order to successfully cut or edit a sound motion picture, must have a background of intelligence which enables him to know the best dramatic, comedy, melodramatic or farce tempo of the scene. Slow tempo may make the scene draggy and uninteresting, while some other tempo may on the contrary be too racy or fast, by reason of which the characters on the screen tell their story too quickly and interest is lost.

When a picture is too slow in unfolding its theme or story, the film editor is required to use all of his intelligence to eliminate the slow portions and speed up the action. He must at the same time keep in mind the fact that the story should be tangible and easy to understand after these eliminations have been made.

Practically the same thing applies to a story which is too fast. The cutter must, by adding other film between dialog scenes, slow down the tempo of the entire sequence.

"Spotting" of Dialog

The use of dialog during dramatic scenes is of utmost importance to the finished picture. When a dramatic scene is in progress it is oftentimes best to have the dialog of the character delivering the speech come over the scene of those who are listening to it, so as to get their reaction to what is being said. At other times, it is more dramatic to stay with the person who is speaking, because much of the drama and force may be lost if the facial expressions and tone of the voice is not seen and heard at the same time. The same technique is oftentimes used in comedy as well as in drama.

The film editor can do practically the same tricks with his film and dialog as he did in the days of silent pictures with titles. For example, if the scene he is working on has a great amount of dialog and eliminations have to be made because this dialog repeats itself, or is too cluttered up with words, he can, if he has the necessary film (close-ups, medium shots, long shots, etc.), move this film and dialog around in such a way as to cut

(*Continued on page* 30)

priority to economics rather than to the safeguarding of human lives. There need exist small doubt as to the answer of you gentlemen to the question posed by the cry of "Dollars against lives." Further, I have yet to hear of any theatre which was forced out of business or even seriously inconvenienced by the cost of a second projectionist.

Also significant is the fact that none of the larger chains appear in opposition to this measure. Why? The answer is simple: the larger chains are operated by first-class showmen who have learned through long experience that good projection and adequate safeguarding of their patrons can be had only through sufficient manpower in the projection room. Still, the requisites for good projection and the danger from film fires are no less in a 500-seat theatre than they are in a 5,000-seat theatre. Size has nothing to do with this matter, as a projector and its associated equipment are identical in every theatre.

Projection Merchandising

A motion picture exhibitor does not sell his marquee, his lobby, his frescoed walls, or his comfortable chairs. One can sit in a comfortable chair at home. Mr. Exhibitor has only one thing to sell, and that one thing is projection. The picture itself is not merchandise until it is properly sold through good projection.

It has been said that, since this State already exercises sufficient vigilance in insuring the safe operation of projection rooms, no further action is necessary. But, who shall say that if the matter be important enough to warrant constant vigilance on the part of the State it is not important enough and worthy to be enacted into law? Mere regulations or pronouncements by departmental heads offer too many chances for the trickster to evade responsibility. What is needed is a law to serve the best interests of all peoples in all localities—city and town—in this State.

3. ONE-MAN OPERATION IS INHUMANE

The next and final consideration is that one-man projection room operation is inhumane from the viewpoint of the projectionist himself. Already engaged in a hazardous occupation, proven by the very much higher life insurance rates assessed against him, the projectionist is now asked to shoulder added work and increased responsibilities through the medium of one-man projection room operation.

A recent industrial award by the State of Wisconsin definitely recognizes the following as occupational hazards of the projectionist:

1. Damage to the eyes from the intense glare of light reflected from the light source; at times direct exposure to the full force of such light source.

2. Excessive room temperatures. Frequently, continuous poor ventilation, even in theatres which provide a cut-in to the main ventilating system.

3. Lead poisoning, the result of inhaling fumes from the carbon arc, the carbons used in projectors having a lead content.

4. Tuberculosis, caused by the inhalation of the fumes from burning carbons, which transmit free silica in large quantities to the projection room. A contributory cause is 1 (above), poor ventilation.

Physical Necessities

We come now to a very important consideration. Let us assume that a projectionist, for physical reasons, is required occasionally to leave the projection room. What will happen to the running projector, if a second man be not available? The answer is so obvious that it requires no effort on my part. Or, should the projectionist, acting upon the classic advice of one New York theatre owner, invite serious physiological injury by either doing nothing or "doing what a dog does?"

To sum up, gentlemen, it is apparent that the proper operation of a theatre projection room requires that at least two men be on duty at all times. By no stretch of the imagination can this measure be construed as a labor measure. Neither should it be considered as a departure from accepted practice, because two-men projection shifts have always been accepted practice—no less in 1920 than today. Since 1920, however, the modern projection room has had added to its equipment the sound reproducing apparatus, increasing twofold the projectionist's responsibilities.

Exhibitors may talk economics, but no talk of economics can dislodge the technical facts which I have presented here today. My indorsement of this measure is based on the information which I have presented, and I feel that you gentlemen will endorse this bill for the same reason—for the safeguarding of the interests of those people whom you represent.

I shall be pleased to answer any and all questions by any member of the Committee or by anyone else interested in this hearng.

Addendum:

Since the foregoing matter was prepared, the National Research Council, a Canadian Government agency, has kindly released to INTERNATIONAL PROJECTIONIST a copy of a letter received by the Council from the Projection Practice Committee of the Society of Motion Picture Engineers. This opinion of the S. M. P. E., which may be inserted into the foregoing presentation, preferably at the end, and either read to or filed with that body before which the presentation is made, appears elsewhere in this article.

Exchange Practices Which Affect Theatre Projection Work

A recent report of the Committee on the Care and Development of Film of the S.M.P.E. contains much of interest to the projectionist relative to general exchange procedure, particularly with respect to mounting, inspecting and seasoning of film both prior to and after its exhibition in the theatre, and reel length. Abstracts of this report should help the projectionist in formulating a well-rounded view of an activity which directly concerns theatre projection work.—EDITOR.

NUMEROUS systems are advocated for treating release prints chemically or physically in order to increase the life of the prints and eliminate projection difficulties. When new prints are projected there is a strong tendency for the emulsion to deposit on the tension shoes or aperture plate of the projector. The result is that abnormal forces are caused to act on the perforations, and the film may be seriously damaged. As this difficulty appears after the print has been projected several times, it is desirable to treat the new prints by some method that will give them the same characteristics as prints that have been projected a number of times.

In one system the gelatin is caused to swell, thus permitting to be introduced into it substances that harden the surface and cause a glossy finish. After receiving such a treatment the film is supposed to be able to resist successfully any normal mechanical attacks. This method of seasoning requires special laboratory equipment, or the film must be sent to a seasoning laboratory. Several other systems, claimed to effect the same results, involve a patented solution which is added to the fixing bath.

Treating and Processing

Although some of these systems appear to have merit, most of the laboratories are content with edge waxing and buffing. Sometimes the buffing is omitted, the edge waxing being done automatically as the film emerges from the drying cabinets.

When preparing a print for the ex-

change, it is desirable that the laboratory treat it so that:

(1) The pulling or straining of perforations, due to deposits of emulsion on the tension shoes or aperture plate of the projector be eliminated.

(2) The emulsion be so toughened as to resist scratching of the surface of the film as far as possible.

(3) The warping and buckling of the film, caused by the heating of the gelatin by the projection lamp, should be reduced as far as possible.

(4) The pliability of the gelatin and its binder should be as permanent as possible, so that the useful life of the film may be made at least equal to the booking period.

Capacity of Reels

A standard size of reel, agreed to and used by both the exchanges and projectionists, must be adopted for the good of all concerned. The mounting of film in the exchanges on 1,000-foot reels for transportation, the subsequent transferring of the film to reels holding from 1,500 to 3,000 feet of film in the projection room, and the re-transfer to the original 1,000-foot reels for return to the exchange represents a great deal of lost motion. Needless time and effort is spent by the projectionist in making such changes. A like amount of time and effort is lost in the exchange inspection room in checking the correctness of the footage and of the heads and tails of the reels.

A large amount of film footage is lost because of this practice, and either all film should be mounted on large reels in the exchanges, or projectionists should be forced to discontinue the practice of mounting two or more reels of film on one large reel. From an exchange standpoint, the 1,000-foot reel is far more desirable, owing to the greater ease with which it can be handled and the greater efficiency with which it can be inspected.

The tensile strength of new film and its elongation properties will permit reels to be doubled under proper working conditions without damaging the film; but when the film has become seasoned the perforation area admits of less elongation than the center of the film and is, therefore, subjected to the entire strain of the traction load of the film in the upper and lower magazines.

The braking surface in the upper magazine, for properly controlling the feed of the film when the double reel is full, causes a tension to be applied to the later footage of the reel that often is greater than the elongation of the perforation area permits. The perforations, as a result, break down.

Proper Tension

In the lower magazine, improper adjustment of the friction drive or the take-up will often cause a similar condition in the early footage of a reel. The variation of the shaft speed of the take-up, caused by the increasing of the circumference of the reel as footage is added to it, is compensated for in a friction drive that must be precisely adjusted to drive the take-up steadily when the reel is filled. The friction required to cause such a steady drive of a full reel is greater than that required for the incomplete reel; whence there results a tendency, in the early footage, for the reel to take the film faster than it is fed out by the lower sprocket.

Insufficient tension on the friction drive of the take-up will halt the loaded reel momentarily, thus creating a slack in the film between the take-up reel and the lower sprocket. This slack permits the take-up drive to operate under no load, and the reel accelerates ahead of the feed of the lower sprocket, tearing the film at the lower sprocket when the end of the slack is reached. Suggesting a remedy for this, the sub-committee believes that it would be well for the exchanges to consider mounting all film on 1,000-foot reels having 5-inch hubs, instead of on the 1,000-foot reels with the 2-inch hubs now universally used by the exchanges.

Cure for Doubling?

Because of the larger hub, the reel can be made considerably stronger, and a more positive stand can be consistently taken against the doubling of reels by projectionists. Such a reel would vacate two of the faults of the reel now generally used by the exchanges that most projectionists offer as reasons for doubling reels: namely, a uniform reel for use in the upper magazine, and a reel with a 5-inch hub for the take-up in the lower magazine. This size of reel could be used without materially changing the present shipping cases, vault racks, or equipment in the inspection rooms.

The cost of a strongly built reel with a 5-inch hub would be greater than that of the reel now used; but it is the opinion of the sub-commitee that this difference in cost would be more than offset by the probable saving of time of inspection, the elimination of doubling of reels, and the loss of film at the beginnings and ends of the reels.

Cleaning of Film

A film record card should be made out for each print, on which is kept a record of the condition of the film, its location while in the vaults, full data on playing dates while out of the house, the inspector's initials, and the date of each inspection. Film should be graded as to its condition in the following manner:

No. 1: good in every respect.
No. 2: good; film damaged slightly.
No. 3: film in poor condition.
No. 4: junk film.

Film can be satisfactorily cleaned by cleaning machines now on the market. If done in the exchange, it is impracticable to attempt to clean film by hand. All cleaning fluids should be non-inflammable and uninjurious to celluloid or gelatin. Carbon tetrachloride can be used satisfactorily for cleaning film, as can trichlorethylene, but the use of either requires proper ventilation.

For exchanges that operate their own cleaning plants, the sub-committee recommends the use of a machine that submerges the film in the cleaning fluid, cleans the emulsified dirt and oil from the film by passing the

(*Continued on page* 28)

SINGLE REELS WITH 5-INCH HUBS

Excerpt from Report of S.M.P.E. Committee on Care and Development of Film (Exchange Practice Sub-Committee)

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SOUND EQUIPMENT SERVICING BY PROJECTIONISTS

Aaron Nadell

***This is the first of a series of articles by Mr. Nadell which will cover completely the operation of sound system servicing by projectionists, an activity pioneered by INTERNATIONAL PROJECTIONIST. The value of these articles can be increased manifold through the cooperation of projectionists in submitting comment and questions relative to procedure, equipment and prices.*—Editor.**

THE proper servicing of sound equipment is shown by experience to require much more than the mere making of repairs. Repair work is one part, but not the only and not always the most important part of service work. The mere ability to correct trouble is far from being the only requirement for good servicing. It is the first requirement—no more. There are at least four others.

Perhaps it will be helpful, before listing these requirements, to take an imaginary but commonplace example of sound equipment trouble and follow through on the normal treatment of it to a complete conclusion of the job. Such an illustration of the full extent of the necessities of normal good servicing should add force and meaning to the abstract discussion of those necessities which will follow.

Suppose then, sound stops suddenly. What is required—of a *good* service man?

The first requisite is not merely finding and fixing the trouble sometime or other, but finding and fixing it in a hurry. There is an old and familiar saying to the effect that the "show must go on." The service man must not only know how to do his work, he must know how to work fast. There is a definite method—a technique—for doing such work rapidly which will be described in detail later. For present purposes, let us assume that it has been done properly, and that it has revealed burnt-out fuses and a broken-down filter condenser in an amplifier. The next step, of course, is repair.

On the assumption that this is a typical case of trouble, it is proper to assume further that replacement condensers of the right type are not available in the spare parts box. Telephoning an order for one and sitting down in a silent house to wait until it arrives is not good servicing. Some emergency step must be taken.

Several steps suggest themselves. The short-circuited condenser or condensers may be disconnected and the amplifier operated without them. The resulting hum may be annoying but bearable. If the hum is too loud, or if arrival of replacements will be greatly delayed, two other courses are possible. Condensers temporarily suitable can be bought or borrowed at a radio store. This amounts to replacement of the damaged part with a temporary part performing the *same* function. But it is also possible to eliminate the entire rectifier and filter pack and operate the amplifier, temporarily, by means of "B" batteries. This amounts to replacing the damaged part with a *different method of operation* that will nevertheless achieve the same results for the time being.

Repair Speed Essential

Thus, if the first requirement of service is to find trouble, and the second is to find it in a hurry, the third is to *fix it in a hurry,* permanently or haywire, so that the show can go on. If the haywire adjustment has been resorted to in order to maintain the show, the fourth step, of course, is to make a careful, permanent repair at some later and convenient time.

When these four steps have been accomplished the work of servicing that trouble is not over. *It has scarcely begun!*

In the case of the imaginary trouble here described, when new condensers of the right type have been received and installed, only one part of the service job has been accomplished. For the sake of the convenience of this discussion that part will be called here, arbitrarily, "direct servicing." The other part, merely for the sake of convenience, will be called "secondary servicing."

The secondary servicing of the trouble described here relates to means of preventing the same trouble from occuring again. Every trouble is an opportunity—an opportunity to prevent the recurrence of the same or of other troubles.

Secondary servicing in this case begins with an investigation of the *cause* for the condenser breaking down. There may be no particular cause. It may have been just one bad condenser that happened to pass factory inspection. In that case no secondary servicing is indicated except, perhaps, depending on local conditions, the stocking of a spare or two in the case the same trouble should recur.

On the contrary, there may be a definite cause. Perhaps this particular condenser is rated too closely to its requirements, with insufficient safety factor. It may, perhaps, be an 800-volt condenser used on a 750-volt line. In that case it should be replaced with another type rated at 1,000 volts.

But the fault may not lie with the condenser at all. The breakdown may, perhaps, have been caused by high line voltage. In that case a condenser of higher rating may be a danger rather than a help. It may prove the strongest link in the system instead of the weakest and therefore leave some other part, more expensive and more difficult to replace (the transformer, perhaps), to stand the strain. Secondary servicing then directs its attention not toward the condenser but toward the line voltage.

Assume the line voltage to have been the cause of the trouble. Direct servicing has been completed. The proper repair has been made. Secondary servicing may well begin by approaching the power company and finding out what they can do toward better regulation of their voltage. In most cases they will not be equipped to do anything, and the necessary adjustments will have to be made in the projection room.

The next part of the service job, then, is to investigate the methods of voltage regulation available, the reliability of each, the price of each, the installation cost and the operating cost of each type of line regulator on the

market. The service job has now become a purchasing agent's job. The requirements of a good service man, it can be seen, have expanded. He must know more than his own equipment. He must keep in touch with the latest developments in kindred and allied equipment. He must know what manufacturers to approach, and be more or less familiar with comparative prices.

Having found a sufficiently large number of voltage regulators that will be satisfactorily reliable for his own purpose, he must next compare costs. How easily installed and inexpensive is each of these types? That question must be uppermost in his mind when he is comparing prices. But beyond that, he must inquire how much each regulator will cost to maintain, and how much current each one will consume. Price comparisons alone will not tell him which regulator is the least expensive. All these factors must be figured in. When that has been done he is in a position to estimate the *true cost* of each regulator under consideration. Then, when he has compared true costs with probable reliability he knows which make of regulator he wishes to buy. It is, as said, a purchasing agent's job. But it is also the service man's job. No one else is as competent to do it.

Assuming that high line voltage was responsible for the imaginary case of trouble under consideration, the job of servicing that trouble is not completed until a proper voltage regulator has been installed and is operating. A temporary repair is not a complete service. A permanent repair is not a complete service job if the same trouble is likely to happen again. The trouble that started when sound suddenly "went out" has not been finally cured until every reasonable step has been taken to make the same trouble impossible in the future.

It can be seen that *completing* a service job may involve far more than making repairs. In the case just imagined, it involves a purchasing agent's work in selecting the best possible voltage regulator. But instead of line voltage, a short-circuited tube may have been the cause of the trouble. In that case, completing the service job may call for laying down a tube testing procedure that will prevent the use of inefficient tubes in the future. The test procedure may show that too many tubes of the make used are poorly inspected and dangerous, and again call for the work of a purchasing agent in selecting a new and more desirable make of tubes.

It will be seen also that although a distinction has been made here between direct and secondary servicing, that distinction relates only to the convenience of the present discussion and has little existence in practice. There is no hard-and-fast dividing line between one kind of servicing and another. Referring for the last time to the imaginary case of trouble used here, it is plain that the cause of the interruption to the show has *not* been determined when the damaged condenser was found.

Good Servicing Requirements

If a short-circuited tube were the cause and were left in its socket, the new condenser, when installed, would break down immediately. Again, if it were known that the condenser in question was inadequately rated, the direct and the secondary servicing had best both be done at the same time, by ordering a 1,000-volt replacement condenser instead of one of 800 volts rating. There is no direct and secondary servicing; it's all one job, depending upon the circumstances, but the classification is helpful in an analysis of that job.

On the basis of the imaginary conditions just cited, the nature of the following requirements for good servicing work should be tolerably plain:

1. An inspection routine, rigidly adhered to, is an indispensable necessity for an intelligent servicing job.

2. The work, whatever it is, must be done rapidly to maintain or restore the show. Emergency methods to be utilized as necessary.

3. A permanent repair is a repair that will last. Recurrence of the same trouble indicates an incomplete or careless job.

4. The work must be done as inexpensively as possible.

5. Every service job, of whatever nature, offers an opportunity for effecting permanent improvement in the operation of the equipment.

As an appendage to the latter requirement, it can be said that permanent improvement may be secured through changes in equipment or methods as will tend to prevent the reappearance of a given trouble. Under the general heading of improvements also come those changes which are likely to effect reduced operating costs or improve sound quality.

The real job of a service man, however, is not repair work at all, no matter how well it may be done. His real job is to keep such careful watch

Jail Sentence for Kaplan in Conspiracy Case; Other Ex-Officers of 306 Fined

SAM KAPLAN, deposed as President of Local Union 306, New York City, by the International Alliance, was found guilty of conspiracy against the "opposition" members of the Union, in the recent trial before Judge Nott in General Sessions, New York. Nine other ex-officials of the Union also were found guilty.

Kaplan and Theodore Greenberg, ex-organizer for the Union, received terms of not less than six months and not more than 3 years in the penitentiary. Eight other defendants received fines as follows: Messrs. Eichhorn, Castle, Wolheim and Avzar, $500; Messrs. Feinberg, Day, Rotker and Paster, $250.

The Kaplan attorney, Max Steuer, immediately requested that the District Attorney be made to show cause why the execution of the sentences against Kaplan and Greenberg should not be postponed pending appeal. Should this motion fail to carry, these two defendants would be jailed immediately pending their appeals. Close observers at the trial opine that the Kaplan appeal would not be sustained.

Should Kaplan carry through his appeal move, there is a possibility that Judge Nott may not adhere to his original intention to recommend to the Parole Commission that Kaplan and Greenberg serve only the minimum term of 6 months, in which case an indeterminate term of up to three years might be put in force.

It was reported in New York that Kaplan had made an ineffectual effort to appeal the decision of the Appellate Department which upheld the power of the I. A. to remove Kaplan and his associates from office. Since the Appellate decision was unanimous, Kaplan would have to secure the approval of one of the five Justices in order to take the case to the Court of Appeals of New York State.

In connection with this reported move on Kaplan's part, it was pointed out that the 30-day limit which applies to such appeals had already expired. This action by Kaplan was seen as an effort to effect a wedge between himself and the necessity for serving the jail sentence in the conspiracy case. Neither the I. A. nor Local 306 participated in the conspiracy trial.

on his equipment, and to arrange such an inspection routine as will enable him to foresee probable trouble and to effect the necessary repairs before the trouble occurs. All other servicing work, no matter how well done, is but a poor, second-best attempt to make up for a failure to meet that first and all-important requirement—inspection! *The only good service work is the kind that anticipates trouble.*

There is one more requirement. The good service man is always alert for improvements, new apparatus recently developed: "tricks" and "dodges," so-called, that will help to prevent trouble, to improve the sound or reduce operating costs. Therefore: *Good servicing keeps abreast with technical progress.*

Labor Costs

The labor cost of any repair job, or of servicing over-all, will depend largely upon whether the projectionist is paid for the overtime involved. Where the projectionist is not the person responsible for servicing, overtime is simply another cost to be figured into the job in the same way that all costs are figured. But if the projectionist is to do his own servicing and is also to be paid for overtime at an hourly rate, the situation, to face it frankly, is one that in some localities may tend to hinder the transfer of servicing responsibilities to the projectionist. This is a problem into which the present writer has no wish to enter, but this question will persistently crop up and is one which projectionists will have to take into account.

It is plain enough that the job outlined in preceding paragraphs calls for a man who possesses considerable special knowledge. The average projectionist is in possession of much of that knowledge. With regard to details of his own projection room—details infinitely important for fast and economical work—he knows or can easily find out more than even the very best service engineer who is concerned not with one theatre but with many of different type and varying conditions. The projectionist is in most cases at least tolerably familiar with the electrical and mechanical principles of his sound equipment. The special technique for fast work, the "haywire" emergency repairs that are often possible, the practices of good purchasing and the layout of good routine for inspection are familiar matters to him.

It is proposed in the articles which will follow to rehearse those and other requirements of servicing under the six general headings which have been cited previously.

(To Be Continued)

QUESTIONS and ANSWERS ON PROJECTION SCREENS

R. T. Rasmussen

THE appended questions and answers constitute the second of a series to appear in these columns. The first installment of this series was received favorably by readers of INTERNATIONAL PROJECTIONIST, but for some inexplicable reason evoked considerable unfavorable criticism on the part of certain screen manufacturers—none of whom, it is worthy of note, could be prevailed upon to sanction publication of his views. Resumption of the series at this time and its continuation in subsequent issues will provide another test of the willingness of these critics to have their opinions expressed in print.

It is desired to emphasize the fact that these questions and answers are not intended to be controversial or to constitute a rebuttal of data on screens from other sources but represent the results of careful tests conducted by competent workers using every modern testing facility.—EDITOR.

13. *What is a Directive Screen?*

A directive screen is a diffusive screen with tiny glass globules imbedded in the surface; they are usually called "Beaded Screens." A directive screen (beaded), has the same brightness characteristics before the glass crystals are applied as the diffusive screen. After the glass crystals have been applied, the brilliancy is increased 3 to 4 times. At an angle of 50 degrees, the ratio of brilliancy as compared to a line normal to the center of the screen is about 1 to 4. Therefore, in general use, the directive screen is brighter than a diffusive screen up to 20 degree angles and is as bright as the average diffusive screen at the 40 degree angle. Their advantages are as follows:

A. The picture increases in brilliancy as the distance from the spectator to the screen increases. This makes the picture more brilliant at the rear seats, and properly so.

B. Their great brilliancy results in decided economies in current and carbon costs.

C. They reduce glare at the seats near the screen.

D. Because of their brightness they add life and brilliancy to colored pictures.

E. They combine the best characteristics of the diffusive and metallic screens.

14. *Where should a Directive or Beaded Screen be used?*

Beaded screens should be used in all theatres where the length is greater than the width and where the projection angle is less than 20 degrees. They should always be used with Mazda or low intensity lamps.

15. *Where should a Metallic Screen be used?*

A metallic screen should be used only in theatres that are more than twice as long as they are wide and where the projection angle is practically at a level with the center of the screen. At viewing angles greater than 20 degrees from the normal, metallic screens have a very low brightness. The fadeaway in some types is as high as 70 per cent.

16. *Will a Perforated Screen turn yellow?*

Perforated screens will turn yellow. The yellowing is caused by age, dust and dirt. Yellowing of the surface is accompanied by a reduction in reflection value and by an undesirable color-tone which is imparted to the picture. The yellowing is caused by gums and binders in the coating composition.

Losses in reflection value, due to yellowing, run as high as 50 per cent after the screen is a year old.

17. *Will a Beaded Screen turn yellow?*

A beaded screen will turn yellow, but only that part of the surface that is not covered by glass is yellowed. The coating medium into which the bead is imbedded does not turn yellow because the air cannot reach it, and there is, therefore, no oxidation of the gums and binders holding the pigment together.

The loss in reflection value, due to the yellowing of a beaded screen is from 1 to 2 per cent after one year's use. A beaded screen that appears yellow, held in direct light will appear a pure white under projected light.

18. *Will a Chromolite Screen turn yellow?*

Chromolite screens will not turn yellow as a result of oxidation. The

PHOTO-ELECTRONIC EMISSION

Pardee D. Colson

TECHNICAL literature available to the projectionist has devoted considerable attention to the photo-electric cell, and rightly so, because the photo-electric cell is the heart of the modern sound projection system. The photo-electric cell is becoming more and more important in fields other than sound reproduction. This is only natural, because this cell is the only sensitive device that can simulate human vision.

A majority of technical information on the photo-electric cell deals mainly with that property of the cell to respond to variations in light intensity, these light variations being converted by the cell into electrical variations. We are told that this property of the cell is due to the fact that the light causes it to emit electrons. While this information serves every practical purpose for the projectionist, an investigation as to why the light causes the cell to emit electrons might be interesting.

Atomic Structure

The work of Bohn and Rutherford on atomic structure paved the way for many advances in our modern conception of the structure of matter. It is unnecessary to go into detail in developing these theories, as the fundamental idea will serve our purpose well enough.

Every atom is believed to consist of an extremely small nucleus, in which is contained all the positive electricity of the atom and part of the negative electricity. Around this nucleus revolve additional electrons charged with negative electricity. When the total negative charge of these outer electrons equals the excess of positive electricity in the nucleus, the atom is said to be in a neutral state. According to Bohn, each atom has as many outer electrons as its atomic number, thus hydrogen has one electron; helium two, etc. Bohn further states that the electron may revolve in one of several orbits. When the electron drops from an outer to an inner orbit, radiation results. These electrons can be affected by some external applications of energy, such as heat, electricity, and, as will be seen presently, light.

In order to account for the energy level in radiation, Max Planck, in 1901, proposed that light or radiation is emitted in small indivisible grains called *quanta.* The amount of the quantum energy is dependent upon the frequency of the radiation. The higher the frequency, the more energy is contained in the radiation. Thus, X-rays have far more energy than radio waves. In connection with the Bohn theory, the quantum theory fits perfectly; in fact, Bohn based his theory on that of Planck's. In an atom, according to Bohn, the electron may be displaced in its orbit by absorbing energy from any incident radiation. If the right amount of energy is incident the atom may break away from the influence of the nucleus.

If light that is strong in ultra-violet rays (short waves), is projected upon a plate of zinc that is perfectly clean and placed in a vacuum, and a thin grid is placed close to the zinc plate, and these two electrodes are connected suitably to a quandrant electrometer, it will be observed that the zinc plate becomes positively-charged. The action of the light causes the zinc plate to lose electrons.

Light acts upon the molecule (i.e., silver bromide), in the photographic film and not upon the atoms, except insofar as the molecules are composed of atoms. An everyday demonstration of the action of light upon a group of dissimilar atoms, i.e., molecules, is in photography. The light causes a disturbance within the molecule which results in a chemical reaction.

Photo-Electric Constants

That photo-electric emission could be explained on the basis of the quantum theory was proposed by Einstein in 1905. His conception is that an electron is emitted by radiant energy and has the same amount of energy as the impressed quanta, minus the energy necessary to remove the electron from the surface of the metal. This theory has been verified by Milliken.

The energy that an electron must have in order to emerge from the metal surface is known as the *work function.* The work function of all metals is not the same, that of some metals being so high that they are not affected by visible light. The energy of the incident radiation depends upon the wave-length of light; the higher the frequency of the radiation, the greater the quantum voltage.

"Photo-Electric Threshold"

When the energy of the incident radiation equals the work function a state known as the "photo-electric threshold" has been reached. The photo-electric threshold must be exceeded before emission can take place.

The energy necessary to remove an electron from the atom is the ionization energy or potential. This energy is not directly connected to the work function. The work function is always less than the ionization potential.

In removing an electron from the atom, we think of a single atom removed from the influence of all other atoms. In photo-electricity, however, we consider the entire group of atoms forming the metal and remove electrons which do not necessarily belong to any one atom but to the metal as a whole.

Two General Laws

The first law of photo-electricity is that "the photo-electric current has a magnitude which is in direct proportion to the intensity of the incident light." The second law is that "the energy of emission of photo-electrons is determined only by the frequency of the incident light, being directly proportional to this frequency." These two laws cover in general almost all phenomena relative to photo-electronic emission.

No attempt has been made here to give more than a very elementary account of the effect of electron emission in p.e. cells. For more details and a more extensive discussion the reader is referred to any of the standard texts mentioned in the appended references, all of which are standard works on the subject.

REFERENCES:

Photo-Electric Cells, Campbell and Ritchie; Isaac Pitman, New York.

Elements of Optics, Valasek; McGraw-Hill Book Co., New York.

A College Textbook of Physics, Kimball; Henry Holt & Co., New York.

QUESTIONS AND ANSWERS ON PROJECTION SCREENS

coating compound is wholely inert and not subject to color changes. The color is influenced, however, by contact with coal gases, or smoke-laden air usually found in cities or manufacturing centers.

19. *What is the best sound screen?*

The best sound screen is the one that is best suited to the particular house in which it is used, and which gives the most light to the greatest number of seats. The ideal sound screen is that which allows of no loss of reflection power; that has perfect sound permeability, and brilliancy without glare.

ORGANIZED LABOR: THE FOOTBALL OF THE PICTURE INDUSTRY

BACK two months Mr. Will Hays completed a tiring trans-continental journey and arrived in Hollywood, facetiously referred to as the motion picture capital of the world. Mr. Hays, in case our readers don't know him, is President of the Motion Picture Producers and Distributors of America, the members of which are all the important producers and distributors in the industry, not forgetting the electrics.

Whether completely fagged out by his arduous journey in a stuffy Pullman, or succumbing to the urge frequently visited on all big executives to get off something really soul-stirring is not known, but the fact is that Mr. Hays unloaded the following oracular statement:

"The need of a shorter work week is no longer a theory. It is a condition which industry and government must meet. We have reached a point where the machine must be utilized for its greatest social purpose—the production of leisure—in order to make it an effective arm of industrial progress." Pretty words, worthy of the superb politician who framed them. But that they had no lasting quality we shall shortly discover.

The scene shifts. It is two months later. Around a highly polished table (I assume), in the New York headquarters of the M.P.P.D.A. sit seven or eight men, the alleged "master minds" of the motion picture industry. Yes, the electrics' representatives are present, but we can overlook their presence because these gentlemen never pretended to run one-two-three with the picture overlords when it came to master-minding. All day the conference continues, and the next day it is resumed. A decision is reached. The industry is saved.

"Saving" the Industry

Out go the wires to every nook and cranny of the picture industry: "Cut all salaries fifty per cent effective immediately for a period of eight weeks. Include contract players, and everybody who will stand for it" . . . or words to this effect. The industry is saved.

Let's see just how the industry was saved—and from whom. The last question shall be answered first. The industry was saved from the bankers. Simple. Saved from the bankers for further sport by a bunch of nit-wit overlords. The industry was saved by cutting hundreds of thousands of film workers—actors and actresses, too—and by having every newspaper in the world chronicle the wage-cut on its front pages. What luscious copy for the editorial writer! The motion picture industry, which depends for its very existence upon the maintenance of wages not only for its own workers but for workers in every industry—the motion picture industry that needs badly the nickels and dimes and quarters and half dollars from all classes—setting the pace in a wage cut—and what a cut! Fifty per cent!

Still, on the same day the cut was announced thousands of theatres throughout America were hawking their wares and trying to attract to their box-offices enough admissions to keep their theatres going, to keep the exchanges going, to keep the studios going, to keep the producers going—and, lest we forget, to keep Mr. Hays on the payroll of the industry. Supposing the bosses of the customers which the industry seeks to attract had slapped a fifty per cent. wage cut on their employees so that they would be unable to go to the movies and keep the industry machinery going? Mr. Hays probably would have been mortified.

Out of the welter of words uttered by the alleged big-shots of the industry during those crucial days stood only one man who had the courage to say "No" to many proposals even more ridiculous than that which finally was accepted. This man is Nicholas Schenck, of Loew Theatres, Inc., and had it not been for him this industry of ours would not have operated at all for eight or ten weeks. Mr. Schenck followed up his stand by advancing the release date of a couple of his biggest box-office pictures, and he means to fight back along this same line indefinitely. When the history of these trying times is written, Nick Schenck should be given a special chapter. He earned it.

Thus the echo of the Hays pronouncement on the Coast two months earlier. According to the Hays formula all people would have nothing else but leisure, and nothing else to do but to go to the movies.

The Fruits of Organization

Let's look into this wage-cutting. Obviously, the reason why the cut was put over with so little resistance was because the workers in the film industry were unorganized. Because Mr. Producer was organized, he was able to cut the heart out of the wages of the unorganized workers—and this goes for the players, too.

But the players evidently don't intend to be caught napping again. The net result of Mr. Producer's little horseplay is to set the player on his guard, and even as these lines are written agents are reported busy on the Coast lining up the players into an "association" (nice name for a union), which will have A. F. of L. affiliations and will in future be able to deal with Mr. Producer on an entirely different basis than heretofore. Thus, the immediate effects of the wage cut bid fair to cost Mr. Producer much more than he thought he was saving.

Player organization, and with A. F. of L. affiliation, appeals to this writer immensely. Let us hope that the organization is swift, the choice of leaders with backbone certain.

Several sidelights of the general wage-cutting merit attention. On the day the wage cuts were announced

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Hollywood Hollers

HOLLYWOOD generally has become so hardened to stories of upheaval in New York that many do not yet understand that the situation today is not just another one of those things. Only one point needs to sink in for the true status to be clear to anyone. All future money must come through the box office window. That's the new situation. No more millions from banks. No more millions from bond holders and stock brokers. Every dollar spent in Hollywood must be taken through a box office window. Just concentrate on that thought and you will understand more clearly what is going to happen in Hollywood.—*Hollywood Herald.*

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there appeared an item in New York newspapers to the effect that Mr. Sidney Kent, head of Fox Films, had leased a 13-room penthouse on Park Avenue, center of ultra-ultraism in New York. Some commentators decried this seeming anomaly, but not this writer, who contends that Mr. Kent's services are worth whatever he can get for them. Producers and Unions alike operate on this principle.

They do say, too, that just prior to the general cuts not a few of the more importantly situated executives arranged a tidy salary increase for themselves, so that when the cut did come it didn't mean a thing to them. Ever hear of patent racketeering? That stunt just mentioned is the same thing.

Harking back a bit, there comes to mind the case of one producer-distributor who cut all company salaries so that payments due on bonds could be satisfied. You see, our upstanding film executives are men of honor and never violate a trust—even though they cut salaries to make payments on bonds which they secretly own. Honor is a great thing when it can be worked to one's own advantage.

Now for the Unions, those dastardly associations which have brought the picture business to the brink of disaster.

This writer isn't burning with any fanatical fervor anent the wage cuts. He is just laughing at how much harder a job it is for the industry leaders to cut the salaries of Alliance members than it was to cut the salaries of defenseless clerks, bookers, players and what-not. The reason for this difference, lest you forget, is organization. It is perfectly all right for the producers to organize themselves into an association, the members of which may act in concert to cut the wages of their workers; but it is sinful when a group of workers band together into an organization like the International Alliance and fight a general wage cut. Sin, hell.

"Overpayed" Union Men

They say that Union film workers are overpayed. They say that a projectionist has no right to receive $60 or $70 a week, or a stagehand to get $50 a week, or a cameraman to get $175 a week (when he works)—when thousands of men are available who will work for $2 a day, or even $1 a day. If this be so, why doesn't Mr. Hays kick back all of his salary but $2 a day? or Mr. Kent, or Mr. Zukor, or, in fact, any of the executives of this business? They'll tell you that their jobs are harder, or their experience more extensive, or their abilities more pronounced. Hooey. Every one of these gentlemen, and every other executive in the industry, is getting every dollar out of his job that he can. The same goes for Unions.

A thing is worth what it brings. So think the Unions—and so think the producers, when they sell pictures in the open market not for what they are worth (some of them are worthless), but for what they will bring. This writer has bought pictures for a theatre not on the basis of what they were worth but for what the exchangeman told him he would have to pay. Where does this "worth" argument stand? If men were paid what they were worth, the industry would be practically stripped of its present leading executives—excepting Schenck, of course.

Ever since the organization of Coast studios was accomplished, with the splendid help of Mr. Sidney Kent, Mr. Hays hasn't dabbled much in labor matters. The results of the Coast organization probably indicated to Hays that he didn't possess the same master touch for dealing with Unions as he did for lining up women's clubs so that the brutally boorish pictures produced by the industry might not be drowned in a tidal wave of feminine protest.

Who remembers the Moral Code promulgated some months ago by Mr. Hays? Very few producers, if one is to judge by the character of pictures being produced these days. They think that high salaries payed to Union workers are corrupting this business, but they are all wrong. How many good pictures are made these days to which a fellow might bring his mother or his best girl and not feel a bit embarrassed by the run of sexy stuff that is on display? What entertainment value is there for anybody under 16 or over 40 in the current crop of motion pictures? The answer is, damned little.

"She Done Him Wrong"

This writer prefers to judge Mr. Hays' stewardship on the basis of a current ad which proclaims that " . . . on her wedding night she left him for another man," or on the terribly harsh sex stuff which embellishes the latest Mae West release. And Mr. Hays worries about Unions and salaries! Tend to your knitting.

If Hays can get $2,000 a week, and Mr. Kent can get $2,000 a week, and Mr. Zukor can get $2,000 a week—*because they can get it*—then a projectionist is entitled to $65 a week or $70 a week for the same reason. The Academy might help to keep the unorganized players in line on the Coast but no such agency exists in the theatre field.

The first gag in salary cutting for the Unions was the so-called "splitting-up" of the chains. They split them into little groups of four and five and six theatres, and then proceeded to negotiate with the Unions on an "independent" basis—despite the fact that box-office reports continued to roll into the home offices in New York, *and still do.* The next gag was that of receiverships. With the influx of receiverships out went all contracts. Again negotiations with the Unions were held. Again cuts were granted—and still reports continued to filter into the home offices in New York. It's the same old theatre chain, with the same old grabbers sitting on the New York end, and with Mr. Receiver out in the field doing the dirty work. Decentralization my eye!

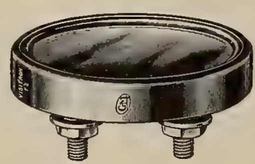
The trouble with the picture business is that for which Mr. Hays has

(*Continued on page* 26)

G-M LABS. INTRODUCES NEW F2 VISITRON CELL

A NEW photo-electric cell which requires no battery or other source of voltage has recently been announced by G-M Laboratories, Inc. The new cell, designated as Vistron Type F2, is suitable for use with current indicating meters, for light intensity measurements, or with sensitive electro-magnetic relays without vacuum tube amplification.

The sensitive disc in the F2 cell is mounted in an attractive, polished durable metal case 2¼ inches in diameter and 7/16 inches thick, which is hermetically sealed. Terminal studs for electrical connections and mechanical mounting project from the rear of the cell to facilitate its use in manufactured assemblies, instruments or experimental work.



A notable characteristic of the Visitron F2 cell is the high current produced at low light levels, the current response being substantially linear for low values of illumination and with low external circuit resistance. In respect to its high current output, it is said to excel other similar cells by a considerable margin. Further information may be secured by addressing G-M at 1737 Belmont Ave., Chicago, Ill.

The IP EDITORIAL PAGE

Vol. 5, No. 1 MARCH 1933

Sound System Batteries Should be Discarded

About a year ago we directed attention to the absurdity of continuing to use storage batteries as a source of power supply for sound systems. Our ideas anent this topic evoked a few hosannas; but the bulk of general opinion was aligned against us. The proponents of storage batteries went to great lengths to prove their case, the substance of their many and varied arguments being that any so-called ripple in power supply would be reflected in poor sound reproduction. There simply could be no argument, they held, on the score of batteries being the *only* known source of "pure D.C." Other arguments advanced in support of batteries were too silly to be consequential.

All this served to strengthen rather than to weaken our stand anent the undesirability of storage batteries. The argument relative to "pure D.C." sounds well but it doesn't tend to alter one iota the fact that not even storage batteries produce "pure D.C." There are any number of battery substitutes which can supply power so free from "ripple" as to hold disturbance currents well below the threshold of audibility—and, after all, this is what counts. Why get so very technical about the subject? The particular job in mind can be done efficiently by other than storage batteries, and that's all there is to the argument.

Storage batteries are a heritage from the early days of sound pictures when the entire industry was in a whirl and the workers therein so dizzy from having to cope with innumerable difficult problems as to let storage batteries slip by as a relatively unimportant question. D.C. was needed, and batteries supplied it—and that was that. But today things are a bit different. The sound reproducing system has benefited enormously through much development work, not a little of which has been directed toward the problem of finding an efficient substitute for batteries. Such a substitute has been found. Why not use it? As far as we are concerned, storage batteries have proven to be an expensive nuisance, and their passing from the sound picture scene should be hastened.

Servicing by Projectionists

In an article relative to sound system servicing by projectionists, which appears elsewhere in this issue, Mr. Aaron Nadell rather timidly and with obvious reluctance introduces a topic which is destined to have a highly important bearing on the success, or lack of it, which attends projectionist efforts to secure and maintain this type of work. We refer to the all-important question of costs—comparative costs as between servicing by projectionists and servicing by sound equipment companies. Mr. Nadell specifically mentions overtime charges, but this item must give way before the far greater import of overall charges.

International Projectionist pioneered the plan of nationwide servicing of sound systems by projectionists, true, but it never had in mind the thought that servicing was to constitute a new source of revenue for the particular projectionist organization which undertook servicing work. Rather did it have in mind the thought that sound system servicing by projectionist organizations should be more in the nature of a defensive move rather than an aggressive one. Through servicing sound systems, we thought, projectionists would accomplish two things, namely (1) rid projection rooms of the dangerous nuisance of having various service men come and go as they pleased, invariably learning more about projection than the projectionist himself learned about sound, and (2) effecting a more binding tie with exhibitors, the projectionists' customers. Out of these two major points stem a stream of lesser considerations the nature of which need not be detailed herein.

There are only two reasons, as we see it, why any exhibitor should consider projectionist sound servicing, and these are (1) sharply reduced costs, and (2) greater protection against trouble through making of servicing a purely localized proposition. Of these two reasons, the first undoubtedly takes precedence in the exhibitorial mind. And why not? To make a success of the plan to switch servicing to projectionists it will be absolutely necessary to effect a sharp reduction in servicing costs. We hold that "sharp reduction" means at least 40 per cent, and possibly more, beneath present costs as assessed by the sound equipment distributors. We have even gone so far as to advocate a projectionist organization taking a loss on its servicing operations, if this be the only method through which it can secure the work. What is a small loss incurred on this basis in comparison with the danger inherent in constant outside interference? Mere trivia. Our stand is "Get the work and keep it." The activity is sure to pay rich dividends, if only the method of calculation is intelligent.

Every passing day sees the sound reproducing equipment field opened up more and more, as though some giant can-opener had been set to work. Every passing day means one more day that projectionist organizations are permitting their privileges to be undermined in the natural process of things. Legal restrictions on the assumption of servicing work by projectionists are virtually non-existent at the moment, and the economic character of the times should prove of inestimable benefit to projectionist aspirations in this direction.

We say, "Go to it." But go to it on a reasonable, intelligent basis, and play all the cards from the top of the deck insofar as Mr. Exhibitor is concerned.

Canadian Units Show Their Mettle

We doff our editorial hat to Canadian projectionists who, the moment their condition of two-men projectionist shifts was threatened, effected a speedy organization of widely scattered units, rolled up their sleeves and proceeded to fight the danger tooth and nail. Apparently these efforts will be rewarded. Despite the fact that there are spotted here and there throughout the United States a few men who really know the value of concerted action and who are constantly looking ahead of today's work, today's conditions, we are forced to admit that nowhere in the United States would it have been possible to effect such coordinated action as has been displayed recently by the Canadian projectionists. In the United States it is very difficult, if not impossible, to unify the activities of even one State group; and within a given district there are as many Napoleons as there are units.

Review of
FUNDAMENTALS OF SOUND

The probability that projectionists will shortly extend their activities to include the servicing of sound picture equipment has generated renewed interest in the fundamentals of sound recording and reproduction. Each month in this department will appear material which will serve this interest.

II. Sound as a Form of Energy

HEAT, as pointed out previously, is another form of energy, and a certain amount of it is produced whenever work is done in any form as a sort of by-product of the work itself. This is usually considered as a loss of energy except where it is produced for a definite purpose.

Frictional losses in machinery result from the transformation of mechanical energy to heat energy. If the bearings are not kept lubricated so as to reduce this loss, the bearing surfaces will heat up and become pitted if not entirely destroyed. Also, whenever an electric motor is run or electrical energy is transmitted, a loss occurs in the wire leads, which is called a *resistance loss.* Therefore, it is necessary to use wire large enough to prevent high losses and excessive heating. In the case of an electric flat iron or other heating device, the transformation of electrical energy to heat energy is not considered a loss because it is produced for a useful purpose.

(*e*) *Mechanical Energy.*—There are two kinds of mechanical energy: potential energy and kinetic, or dynamic, energy. *Potential energy* exists by virtue of the position or condition of matter. An example of potential energy stored in matter by virtue of its position is a mass elevated to a position from which it can do work when lowered, such as a reservoir of water at an elevated position, which can be made to turn water wheels at a lower elevation for driving machinery. An example of potential energy by virtue of condition is a compressed gas which can be made to perform work when released, or a rarefied gas (vacuum or partial vacuum), which can also be made to do work. A common example of this is the windshield wiper of an automobile where the wiper motor is worked from the vacuum tank.

Dynamic energy exists in moving bodies. It requires work to set a mass of matter in motion and likewise to stop it once it is set in motion. An example of kinetic energy is water flowing in a pipe. If we consider again an elevated reservoir supplying water to a water wheel, we will remember that the energy of the water when it was in the reservoir was potential energy. The water is piped to the water wheel, and at a point just before it comes in contact with the wheel it has no longer any potential energy, although its energy has not yet been used in turning the wheel; but the potential energy which was in the water in the reservoir has been converted to dynamic energy or energy of motion.

In order to obtain a clear understanding of the difference between potential and kinetic energy, let us for a moment consider the two principal types of old-time water wheels used by the miller in grinding flour.

One type of wheel—the "overshot" wheel—contained a row of boxes, or "buckets," around the rim of the wheel. The axis of the wheel was horizontal, and the location of the wheel was so chosen that water from a higher elevation could be directed by means of a trough so as to fall into the buckets at the top of one side of it. The weight of the water in these buckets caused the wheel to turn. In this case the energy to rotate the wheel arose directly out of the potential energy stored up in the water by virtue of its elevation.

On the other hand, we may consider the operation of an "undershot" wheel. This type of wheel was similar in its location and mounting to that of the "overshot" wheel described in the previous paragraph, but, instead of "buckets," a number of "paddles" were located around the rim of the wheel and, instead of water being directed over the wheel, it was caused to flow under the wheel in such a way as to strike the paddles. The kinetic energy of the swiftly moving water, upon being brought to bear against the paddles, rotated the wheel.

(*f*) *Sound Energy.*—Sound is not usually considered as a separate form of energy but as a variety of mechanical energy. You will remember that under "Mechanical Energy" it was stated that both compressed gases and rarefied gases contained energy by virtue of their condition, and it was stated that this energy could be converted into work.

Sound being an alternate succession of compression and rarefactions of air is a particular form of energy which is capable of doing work, such as driving the membrane of the ear to produce the sensation of hearing, or driving the diaphragm of a microphone to produce electrical impulses. Likewise, sound waves drive the diaphragm of an Ediphone machine, which in turn, drives the cutting point that makes a record on a wax cylinder. This is similar to the method used in making the old type of phonograph records. In the new method the sound is picked up with a microphone and converted into electrical impulses which are amplified before being converted to mechanical impulses for cutting the record.

Elements of Electricity

Discovery of Magnetism: We are all probably more or less familiar with magnetism and its mysterious behavior. It is not our purpose to try to explain this mystery, but rather to state the simple laws of magnetism, so that you may better understand the operation of the electrical devices of reproducing equipment.

It was known to the ancient Greeks that certain "stones," found in a region of Asia Minor called Magnesia, had the peculiar property of attracting to themselves small bits of iron, and that when two of these "stones" were brought near one another there was sometimes present a force which tended to draw them together, and at other times the force present tended to keep them apart. The Greeks called the "stones" magnets.

It was later found that when one of these magnets was hung, suspended by a string, one portion always turned towards the north. Some of the Mediterranean merchants used these magnets to aid them in navigation. As a result of this use the magnets were termed "leading-stones" or "lodestones."

A still later development arose as a result of the discovery that a piece of iron or steel when rubbed against a magnet acquired its properties to a

somewhat less degree. It would pick up other bits of iron or steel, attract or repel another bit of iron similarly treated, and would take up a definite position north and south when freely suspended. Such a piece of iron or steel is said to be "magnetized." The Italian navigators as early as the tenth century utilized the tendency of a magnetized steel needle to place itself north and south. Their first compass consisted of a horizontal card attached to a cork in which was mounted a magnetized steel needle. The edge of the card was marked with "the points of the compass," and this whole unit was floated in a bowl of water the edge of which was marked in line with the keel of the ship.

The original magnets or "lodestones," which were not really stones, but were instead a combination of two iron "ores," are called "natural magnets"; and magnets made by rubbing pieces of iron or steel against "natural magnets" (or by any other means), are called "artificial magnets." In examining the action of any magnet, it will be found that in at least two positions its magnetic properties will be much more pronounced than at others. These points are termed the "poles" of magnet.

The space surrounding a magnet in which its influence may be observed is termed the "magnetic field."

Nature of Magnetism

Magnetism and electricity are peculiarly related. It has been found that every time a loop of wire located in a magnetic field is moved in such a way as to change the strength of the field with respect to the coil, an electric current will flow in the loop; and also, that whenever an electric current flows in a wire, the wire is surrounded by a magnetic field. These two facts will be amplified in succeeding paragraphs.

If several turns of wire are wound around an iron rod, and an electric current from a battery is passed through the wire, the iron rod becomes magnetized as shown by its ability to pick up iron filings, tacks, etc. If the rod is of soft iron, practically all of the magnetism will disappear when the flow of the current is stopped. If the rod is of hardened steel, an appreciable amount of the magnetism will remain after the flow of the current has ceased, and the piece of steel so treated becomes a permanent magnet. If one end of such a rod is brought close to a magnetic compass, it will attract one end of the compass needle toward it. If the opposite end of the rod is brought near the compass, it will attract the other end of the compass needle. Since a magnetic compass is itself a small permanent magnet, the behavior just described shows the effect of one magnet on another.

In order to study the action of mag-

nets a little more, bring together the ends of two magnetized steel rods which attract the same end of the compass needle, and it will be found that they repel each other; but, if the ends of the two rods which attract opposite ends of the compass needle are brought close together they will be strongly attracted to each other, proving that opposite ends of a magnetized iron rod act differently when brought near one end of another magnet. The pole of a magnet which attracts the end of the compass needle which normally points north is called the south pole of the magnet, and, conversely, the pole of a magnet which attracts the end of the compass needle which normally points south is called the north pole of the magnet. From the above discussion this general rule is formed:—*magnetic poles of like polarity repel each other, and magnetic poles of opposite polarity attract each other.*

Arrangement of Magnets

An iron rod can be considered as being made up of a large number of small permanent magnets. When the iron rod is not magnetized, the tiny magnets will be arranged in a random fashion such as shown in Fig 5 (a). If a wire is wound around the rod and a current is passed through the wire from a battery, the tiny magnets which compose the iron will arrange themselves in a manner similar to that shown in Fig. 5 (c), thus aiding the electric current in producing a magnetic field.

When the flow of current is stopped, the tiny magnets will return to very nearly their original position, and most of the magnetism will be gone if the rod is of soft iron; but, if the rod is of hardened steel, the little magnets will remain more nearly in the position shown in Fig. 5 (b), after the flow of current has been stopped. It takes a stronger current to produce a magnet of the same strength using a hardened steel rod than it does if a soft iron rod is used, but hardened steel retains its magnetism after the magnetizing current is stopped. This leads us to believe that it is more difficult to change the position of the little magnets in hardened steel than in soft iron.

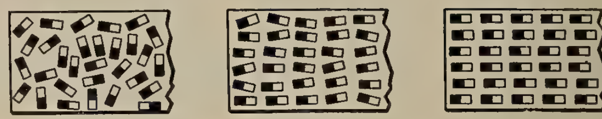


FIGURE 5
Molecular construction of unmagnetized and magnetized material

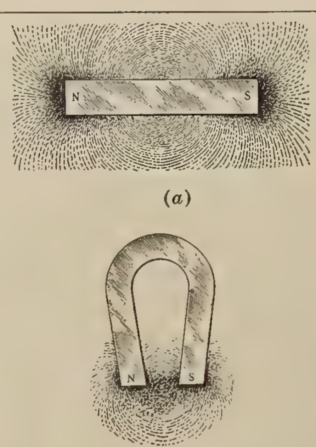
(*a*) (*b*) (*c*)

Lines of Force

If iron filings are sprinkled on the surface of a sheet of paper placed directly over a magnet, the filings will arrange themselves in a pattern similar to that of Fig. 6 (a). If the rod is bent into the shape of a horseshoe, we have what is called a horseshoe magnet, and the pattern formed by iron filings over such a magnet will be as shown in Fig. 6 (b). It will be noticed that the iron filings arrange themselves in curved lines connecting the north and south poles of the magnet, and that the lines of the horseshoe magnet are concentrated within a small area. These lines represent lines of force which are assumed to exist between the poles. Fig. 6 shows that the lines of force are more numerous and more concentrated when the poles are close together.

If a piece of soft iron is placed between the poles, touching one pole but not the other, so as to reduce the air gap between them, the lines of force in the gap will be still further increased. This shows that the number of lines of force varies with the air gap between the poles, and the number of lines of force increases as the air gap is made smaller. In other words, the iron serves as a path of low resistance for the magnetic lines of force as compared with the resistance offered by air. This can be shown more readily by passing a current through a coil of wire and noting the strength of the magnetic field produced, and then noting the increase of the strength of the field when an iron rod is inserted through the coil.

It should also be noted that the coil of wire, without the iron rod through it, behaves exactly like an iron magnet in attracting the needle of a compass when an electric current from a battery passes through the coil. It is important to have a fairly good idea of magnetic lines of force because this



(*a*)

(*b*)

FIGURE 7

WARNERS TURN TO RCA FOR EUROPEAN RECORDING

Announcement has been made of a recording contract between Warner Bros.-First National Productions, Ltd., and RCA Photophone, Ltd., of London. With this new producer, there are now twelve leading British motion picture companies operating under licenses from RCA Photophone, Ltd., a subsidiary of the RCA Victor Co.

ORGANIZER KILLS "REBEL" IN CHICAGO UNION OFFICES

A BATTLE in Chicago Local 110 headquarters between Fred Oser, one of the leaders of the so-called opposition faction within the Local, and Ralph O'Hara, Union organizer, occurred on March 24 last, climaxing a series of squabbles between rival factions within the Union. O'Hara pleaded self-defense.

Oser never owned or carried a gun, according to his widow, the mother of five children, who insisted at the inquest that her husband bore no particular grievance against any official of the Union and, in fact, had gone to Union headquarters on the day of his death at the invitation of Thomas E. Maloy, business representative, for the purpose of "making his peace" with the latter. Oser was one of seven members expelled December 1 last, an event which was followed by a series of court actions to compel their reinstatement. Mrs. Oser's statements were corroborated by Albert Carlson, a brother-in-law of Oser.

Carlson further testified that he had taken lunch with Oser on the day of the killing and that the latter was in a frame of mind where he wanted to settle his differences with the Union. The restaurant being crowded, said Carlson, he had taken Oser's coat and folded it on a chair, and no gun could possibly have been in the coat and escaped his notice. Oser went directly to the Union offices from the restaurant, Carlson said.

O'Hara testified that Oser had come into the Union office and, upon being told that Maloy was out, launched into a vituperative attack upon the Union and all its officers. Subsequently, O'Hara swore, Oser turned his abuse directly upon him and said he "ought to be bumped off." Oser attempted to pull a gun, said O'Hara, but it stuck in his clothing, giving him (O'Hara), a chance to draw his revolver and fire.

A gun expert at Chicago police headquarters opined that the gun which O'Hara said was used by Oser to fire at him was too big for a pocket pistol, following which the inquest was continued to April 1 by the States Attorney, who said: "Further investigation may disclose that this killing was murder, and it may not. But we need more time."

property of magnetism will be referred to repeatedly in later discussions.

As stated previously, all matter is composed of small particles called molecules. These molecules themselves are composed of smaller particles which have positive and negative charges of electricity. Some of the negative charges, called "electrons," are more or less free to move. Normally a molecule consists of an equal number of positive and negative charges. If one electron is taken away, the molecule is said to be *positively charged;* or, if a molecule has one more electron than normal, it is said to be *negatively charged.*

Nature of Electricity

Likewise, if a neutral body has one or more electrons removed from it, the entire body is said to be positively charged, or, if electrons have been added, it is said to be negatively charged.

If either a positively charged or a negatively charged body is brought near a neutral body (one without charge), there will be an attractive force between them; or, if a negatively charged body is brought near a positively charged body, there will be an attractive force between them. On the other hand, if a positively charged body is brought near another which is also positively charged, or, if a negatively charged body is brought near another negatively charged body, there will be a repelling force between them. In other words, *bodies having like electrical charges repel each other, and bodies having unlike electrical charges attract each other.* The reason that a neutral body is attracted by a charged body is that, although the neutral body is neutral within itself, it is not neutral with respect to the charged body, and the two bodies act as if oppositely charged when brought near each other.

If an electrically charged body, such as a metal sphere, is connected by a wire to a neutral body, such as the earth, a charge will flow between the neutral body and the sphere so as to equalize the charge on the two bodies. This flow of electric charges is known as an electric current. The moving charges themselves are called "electrons" and are always negative.

The flow of an electric current can be understood most readily by considering the molecules of which all matter is composed. As stated before, these molecules are made up of equal positive and negative charges (protons and electrons). Some of the negative particles (electrons), are more or less free to move. The number of free electrons and the freedom with which they can move depends upon the substance. Good conductors of electricity, such as copper, have large numbers of free electrons which move with comparative ease, and the application of energy (chemical, magnetic, etc.), in the

proper form will cause some of the electrons to move from one molecule to another in a direction from a point of low to a point of high "potential"—as electrical pressure is called.

This flow of electrons constitutes an electric current.

New electrons to take the place of those which have traveled away from the point of low potential are supplied from the source of potential (battery, generator, etc.). In other words, the source of potential acts as a pump driving electrons into the point of low potential, and pumping them out of the point of high potential.

To explain further, if a copper wire is connected between the terminals of an electric battery, electrons will move from one molecule to another. As one molecule receives an additional electron, it passes another on to the next molecule. Under the conditions just stated, the current flows out of one terminal of the battery through the wire, and back through the battery in a continuous circuit until the circuit is broken or opened. Besides this relaying of the electrons by the molecules the electrons themselves drift along the wire a few feet a minute. An idea of the number of electrons required to produce even a small value of electric current will be gained from the fact that it is necessary for billions of electrons to be in motion through a small electric lamp every second to light it.

In the early days of the discovery of electricity certain terminals of electric batteries were termed positive and negative and the current was said to flow from the positive (+), to the negative (—). In view of later discoveries this assumption is incorrect but has persisted nevertheless. The fact that electric currents are said to flow from plus to minus, positive to negative, or high potential to low potential, when as a matter of fact the reverse is true, gives rise to a great deal of confusion. It is important that you remember this fact: *while current is said to flow from positive to negative, it actually flows from negative to positive.*

(*To be continued*)

ORGANIZED LABOR: FOOTBALL OF THE INDUSTRY

(*Continued from page* 20)

never exhibited any stomach. What has Hays done to curb the overseating evil, now some ten years old? In some towns there is a theatre seat for every three inhabitants; and a seat for every ten inhabitants, babies and invalids included, is the average. What did Mr. Hays do when producers, unable to sell this or that outlet, proceeded to build a fine new theatre, whether they needed it or not, and put the little fellow right on the skids and thus break the backbone of the industry? What did Mr. Hays do when this and that State and this and that municipality slapped a tax on picture theatres and made it stick?

Some might ask what he was supposed to do. He's the boss, or regarded as such, isn't he? He evidently was worrying too much about censorship.

Ask any exhibitor of more than five years' experience what the outstanding industry problem is and has been for years and he will positively answer, "Overseating." Either that or, "Bad pictures," another thing about which Mr. Hays has done nothing.

"Stars" and Real Estate

Two other points come to mind: star contracts and real estate deals. As for the latter, every company in the business was put on the bum through having to pay in 1931-32 the rental on a theatre leased in 1928, at 1928 prices, while the owner did nothing but sit on a campstool and wait for the mailman to deliver the check from New York. And this was after the little fellow had been put out of business by the hoggish attitude of the big companies in the matter of new theatre jobs.

They talk about Union wages, the while Hollywood is cluttered up with alleged "stars" who haven't made a picture in months but are still collecting their weekly salaries, all of which is charged against the business. How about Lillian Harvey, petite Fox importee, who has been on salary in Hollywood for a year and never faced a camera? How about Ann Sten, German actress, who has been on the Coast for a year on full pay and doing nothing but taking English lessons and making silly tests? Who said "Unions"?

The cost of these "stars" will be worked into future pictures and passed along to the exhibitors who will find that film rentals are so high as to cause a request for reduction in Union wages or manpower. How about the hundreds of relatives on Hollywood payrolls, for no better reason than that they sprout from the same family tree as the boss back in New York? These relatives are an important part of film rentals, an important part of general industry economics.

By mutual agreement among independents and chain operators, Cleveland, Ohio, was selected as the spot for

a national test of the power of the Unions. Anyone with even half a mind would have advised against making a test tube out of Cleveland, because the Forest City is the home of one of the strongest, if not the strongest, I.A. Locals in the country. There is no question but that the closing of 92 Cleveland houses didn't just happen, it was a deal. But the organizer of the move picked the wrong spot.

The fun started with independent exhibitors asking for relief during the banking holiday, with 50% cuts being asked. They said they were hard-up, couldn't possibly survive unless relief was granted. Then the chains joined the battle. Investigation disclosed that there hadn't been a single reduction in film rentals throughout the preceding year, and that for the past six weeks film had been shipped to theatres on a strictly C.O.D. basis! This is the kind of relief the independent exhibitors got from the film companies, whose leaders were busy trying to effect a cut in Union wages so as to protect their high film rentals.

It will ever be a mystery how the independents permitted themselves to be talked into an alliance with the distributor chain theatres, the latter fighting with them against the Unions and against them in the matter of film rentals and credit terms. Distributor leaders cursed the Unions, and with tears in their eyes recited the piteous story of doing everything in their power to preserve the industry and keep the theatres open. But not an inch did they budge from their C.O.D. film-delivery policy. They would have to get theirs; to Hell with the Unions. The dumb exhibitors would pull their chestnuts out of the fire by getting a reduction in wages.

This writer has looked high up and low down through the industry press and through the public prints and has never seen a line which mentioned this C.O.D. policy in Cleveland film-deliveries.

Independents-Unions Angle

That the theatres will win over the Unions in Cleveland is to be doubted. Cleveland locals have a fat bankroll, and they can stand the gaff far better than can the distributors, who are losing rentals, and the exhibitors, who are paying rent, open or closed, win, lose or draw. That brainy man who advised the selection of Cleveland as the site of battle on a national proposition to break the Unions should be removed to the nearest psychopathic ward.

The strangest angle to the activities

of the past few weeks is the tendency of so-called independent exhibitors to string along with the chain theatres and distributors in the fight against the Unions. The most natural tie-up in the world right now would be between independent exhibitors and the Unions, with the latter showing every preference to the former and joining hands to oppose the producer-distributor, who really is the natural enemy of both and through whose maladministrations the industry has been brought to its present state of disruption.

With the Unions and independents presenting a solid front, and wielding terrific power through their combined influence with state and national legislators, many of the reforms obviously needed within the picture industry could be achieved practically overnight. Such a tie-up would make short shrift of Mr. Producer-Distributor, who today milks the independent exhibitor and then forces him to fight the battle against the Unions. Someday not far off the combination of independents and Unions will be effected, and then the telegraph wires leading into legislative centers will sing—and Mr. Producer-Distributor will cringe.

Fight on National Scale

As for the Cleveland situation, there are no two ways about it. To the victor will go the spoils, not only in Cleveland but nationally, and this is why no effort should be spared by the Alliance as a whole to back up the Cleveland units. This is not a Cleveland fight; it is an Alliance fight.

As for Mr. Hays, and the M.P.P.D.A., and Mr. Producer-Distributor and all the rest of the "high-power" executives within the industry, take a tip from Mr. Nicholas Schenck and learn what it really means to be a real honest-to-goodness showman and a first-class business man.

JAMES J. FINN.

EXCHANGE PRACTICES WHICH AFFECT PROJECTION

(*Continued from page* 14)

film through a series of soft rubber squeegees, and polishes it by passing it over revolving rollers covered with soft flannel. The machine and the room should be well ventilated.

Film should be inspected and repaired immediately upon being returned from the theatre, and the condition of the film should be noted and recorded on the "film record card." When undue damage has occurred to any part of a print, the record card should carry information of the damage and the name of the theatre responsible for it. The booking manager of the exchange should be furnished with complete data on the damage, repairs made, and the replacement parts ordered when necessary.

Inspectors should not be permitted

to wear anything on their hands other than a cotton glove. While inspecting film, all jewelry should be removed from fingers and wrists.

All film should be inspected from the left rewind to the right, beginning with the "tail" of the reel outward, so that the inspected film reel ends on the right-hand rewind with the "start" or head of the reel outward. As all splices are made by scraping the film on the left of the damaged part, this routine results in a splice that is better fitted to pass through the curves and loops and over the sprockets of a Simplex projector. In splicing, the emulsion should be removed with a dry scraper. Only fresh film cement should be used. A mechanical splice is recommended, and should always be referred to as a "splice" and not as a "patch."

Splices and Markings

The inspector should hold the film so that it passes first over the left hand and then between the fingers. If held so that the film passes under the left hand before passing through the fingers, all the dirt and grit that is on the film collects on the palm of the hand and scratches the remainder of the reel being inspected.

In order to maintain the proper locations of the "change-over" signals in the standard release print, where these have been altered by placing the film on 2,000-foot reels, the "start" mark should always be placed at the correct distance ahead of the action. This distance should be exactly determined in all reels of all prints, and can be maintained by the film footage numbers in the margin of the film. When necessary, black leader film should be inserted between the "start" mark and the first scene of the action in order to maintain the correct distance.

Replacement Film

When splices occur at the ends of reels, shortening the distance between the "start-motor" signal or the "cut-over" signal and the end of the action, replacement film should be inserted; or the "start-motor" signal or the "cut-over" signal should be removed, making new ones at the proper distance from the end of the action in order to provide the projectionist with the correct "cut-over" cues. To avoid mutilation of the film by punch marks, stickers, and scratches, exchanges should notify all exhibitors that the only permissible way of indicating variations from the standard release print markings would be to use a *china marking pencil,* and that such marks should not extend over two frames.

The inspector should examine the marginal footage numbers on both sides of each splice when inspecting sound film, so as to determine the probable deletion of footage. If the deletion is large or important, replacement film is necessary. Companies that do not adhere to a distinctive uniform splice should require that each splice made and examined be stamped with an embossing stamp to signify that the footage deleted has been "okayed." This precludes the necessity of a like examination in following inspections.

FILM EDITING PROCESS

(*Continued from page* 12)

out speeches or have speeches originally intended for the latter part of this scene appear in the opening of the scene, and *vice versa*.

"Wild Dialog" Inserts

Many times the cutter is in difficulties when cutting from one scene to another in dialog, especially when the dialog is spoken rapidly, as he has to cut on a syllable in one scene and in the next scene he cuts on another syllable. Of course, this is taken care of somewhat when the picture goes through the process of dubbing and unwanted words are painted out of the sound track.

Another thing left up to the intelligence of the cutter is the matter of cutting into scenes, extra dialog, or wild dialog which was not recorded at the time the picture was photographed. In other words, some dialog is eliminated at times, because certain words do not register well or are not audible; while in other instances extra words are required. This wild dialog may be recorded a week later, and the cutter has to cut this into the scene as originally made with sound and picture, and match the lip movement as closely as possible; or he may use a part of another character's close-up and allow a certain portion of this new dialog to ride through it, giving a perfect illusion, as though this was originally synchronized with the picture.

Many times a star's voice is not suitable for singing, so a wild recording is made, using a professional singer, while the star merely mouths the words of the song in the picture. A clever film editor, by the use of appropriate angles, can match this wild recording almost perfectly, so that the audience is unaware that the singing is done by any other than the star. In fact, often this wild recording is done in speech and used in the close-up of a character, and the cutter can, by deftness and experience, put portions of this sound track to make the lips of the character speak in perfect synchronization.

Sometimes, certain effects or music must run over dialog, and must start and end on a certain line or portion of the dialog. This is all figured out in timing and tempo by the film editor and it is through his efforts that the effect of these scenes on the audience is carried to its full potentiality.

Shots Without Sound

There are also times when wild shots are photographed without sound, such as long shots of a room, people making exits or entrances. The cutter will on numerous occasions use dialog from the preceding scene which was recorded, and run portions of this dialog over the wild shot to make it "live."

I have seen times during a telephone conversation, for example, when the person who actually does the calling is the one who receives the call. This is accomplished by the cutter in switching around his cuts so that the one who actually makes the call is the first one to answer.

Also on some occasions long shots or medium shots are recorded and when these are cut together with the close-ups, there is a noticeable difference in the sound reproduction. It is sometimes necessary to use close-up sound with long-shot action, or *vice versa,* in order to obtain the optimum sound and picture. While this is not often the case, on occasion the mike will not pick up the necessary dialog from its long-shot position, and it becomes advisable to make this adjustment.

(THE END)

International PROJECTIONIST

Edited by James J. Finn

April 1933
Vol. 5, No. 2

A magazine devoted to better visual and sound reproduction

25c a copy
$2.00 a year

Announcement

INTERNATIONAL PROJECTIONIST announces the acquisition of right, title and interest to and in *PROJECTION ENGINEERING,* heretofore published by Bryan Davis Publishing Co., Inc., of New York City. Effective immediately, this latter publication will be merged with and published under the title of INTERNATIONAL PROJECTIONIST.

Long the undisputed leader among projection papers, INTERNATIONAL PROJECTIONIST now is the only such paper published regularly each month. It will continue to be edited by James J. Finn, oldest projection paper editor in point of service in the field. In its columns each month will be found the best educational articles by recognized writers working on a paid basis, in addition to news of and views upon the very latest developments in the design, manufacture and operating technique of both visual and sound projection equipment. Activities within the craft will continue to form an important part of its editorial content, and its editorial page will continue to be vigorous and opinionated.

This merger of the outstanding projection papers will enable INTERNATIONAL PROJECTIONIST to offer more circulation of remarkably high quality at less cost per thousand than any other medium in the motion picture field. The publishers will adhere strictly to their established policy of helping in every way possible to advance the profession of projection—the inevitable result of which policy will be to serve better those forward-looking advertisers who through the pages of INTERNATIONAL PROJECTIONIST have gained prestige and goodwill in the projection field.

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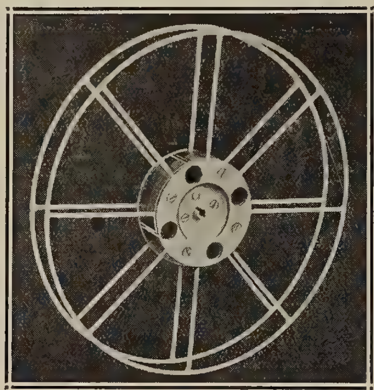

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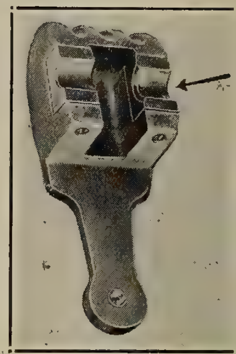

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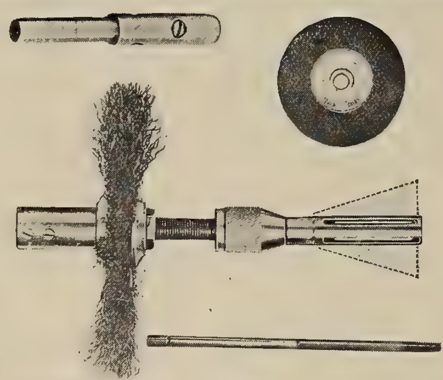

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With Which is Combined Projection Engineering

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MONTHLY CHAT

WITH this issue I.P. welcomes many new readers who accrued to it as a result of its purchase and absorption of "Projection Engineering," a periodical which during its existence served well its readers and advertisers. I.P. does not bear lightly its added responsibilities, and it hopes to be of such service to both its old and new friends as to make hard and fast friends of all. For its part, it earnestly hopes that its new readers will exercise to the fullest extent their critical faculties, so that I.P. may ever be kept on its toes and mindful of and responsive to the needs of its audience.

This yearning to be of service may be nourished properly only by the consistently strong support of all readers of I.P. Whether brickbat or bouquet, the editorial ear of I.P. will ever be attuned to the level which best reflects the needs of a majority of its readers. The line forms on the right.

ONE of the most encouraging aspects of the recent S. M. P. E. session in New York was the attendance thereat of many representatives of businesses not operating within the professional motion picture field. This is indeed a good omen, for the policies and practices of that group of engineers which has had to satisfy the demands of the great god, Box Office, certainly may be applied with much profit to similar activities in the non-theatrical field.

Equally cheering was the presence at the meeting of a group of representatives of various Local Unions of the I. A., indicating that Labor at last is coming around to the sensible viewpoint that quality of work is as important as quantity. It might be added that the Local Unions referred to not only paid the delegates for the wages lost but also the expenses of the trips. A pretty sound investment, says we.

REPORTS from our scouts indicate that extended frequency range sound reproducing systems are going over with a bang in the exhibition field. Frankly, we expected no such demand for high quality sound equipment, having trailed along with the view that most exhibitors bought first, price, then quantity, and last of all quality. Ordinarily we sidestep admitting our mistakes, but this time we bare our chest and invite the punishment.

PROJECTION TABLE:

Showing Size of Screen Images at Different Distances with Lenses of Different Focal Length

Size of Picture Aperture: 0.825″ x 0.600″

E.F. in.	40 ft.	50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	120 ft.	130 ft.	140 ft.	150 ft.	160 ft.	170 ft.	180 ft.	190 ft.	200 ft.
2.00"	16.4 11.9	20.5 14.9	24.6 17.9	28.8 20.9	32.9 23.9	37.0 26.9	41.1 29.9	45.3 32.9									
2.25"	14.6 10.6	18.3 13.3	22.0 16.0	25.6 18.6	29.2 21.2	32.9 23.9	36.6 26.6	40.2 29.2	43.9 31.9	47.5 34.6							
2.50"	13.1 9.6	16.4 11.9	19.7 14.4	23.0 16.8	26.3 19.1	29.6 21.5	32.9 23.9	36.2 26.3	39.5 28.7	42.8 31.1	45.6 33.5						
2.75"	12.0 8.7	15.0 10.9	17.9 13.0	20.9 15.2	23.9 17.4	26.9 19.6	29.9 21.8	32.9 23.9	36.0 26.1	39.0 28.3	42.0 30.5	45.0 32.7	48.1 34.9				
3.00"	10.9 8.0	13.7 10.0	16.4 11.9	19.2 14.0	22.0 16.0	24.6 17.9	27.4 20.0	30.2 22.0	32.9 23.9	35.7 25.9	38.4 27.9	41.1 29.9	43.9 31.9	46.7 34.0			
3.25"	10.1 7.3	12.7 9.2	15.2 11.0	17.7 12.8	20.2 14.7	22.8 16.6	25.3 18.4	27.8 20.3	30.4 22.1	32.9 23.9	35.5 25.8	38.0 27.6	40.5 29.5	43.0 31.3	45.6 33.1		
3.50"	9.4 6.8	11.7 8.5	14.1 10.3	16.4 11.9	18.8 13.7	21.1 15.4	23.5 17.1	25.9 18.8	28.3 20.5	30.5 22.2	32.9 23.9	35.2 25.5	37.5 27.3	39.9 29.0	42.3 30.8	44.7 32.5	47.0 34.2
3.75"		10.9 7.9	13.1 9.6	15.3 11.1	17.5 12.8	19.7 14.4	22.0 16.0	24.0 17.6	26.3 19.1	28.6 20.7	30.7 22.3	32.9 23.9	35.2 25.6	37.3 27.2	39.5 28.8	41.7 30.3	43.9 31.9
4.00"		10.2 7.4	12.3 8.9	14.3 10.4	16.4 11.9	18.5 13.4	20.5 14.9	22.6 16.4	24.6 17.9	26.7 19.4	28.8 20.9	30.8 22.4	32.9 23.9	35.0 25.4	37.0 26.9	39.1 28.4	41.1 29.9
4.25"		9.7 7.1	11.7 8.5	13.5 9.8	15.5 11.2	17.4 12.7	19.3 14.0	21.2 15.4	23.2 16.8	25.2 18.3	27.1 19.7	29.1 21.1	30.9 22.5	32.9 23.9	34.0 25.3	36.8 26.8	38.8 28.2
4.50"			10.9 8.0	12.8 9.3	14.6 10.6	16.4 11.9	18.3 13.3	20.1 14.6	22.0 16.0	23.7 17.2	25.6 18.6	27.4 20.0	29.2 21.2	31.0 22.6	32.9 23.9	34.8 25.3	36.6 26.6
4.75"			10.4 7.6	12.2 8.9	13.9 10.1	15.7 11.4	17.3 12.6	19.0 13.0	20.7 15.1	22.5 16.4	24.2 17.6	26.0 18.9	27.6 20.1	29.4 21.4	31.1 22.6	32.9 23.9	34.7 25.2
5.00"				11.6 8.4	13.1 9.6	14.9 10.8	16.4 11.9	18.1 13.2	19.7 14.4	21.4 15.6	23.0 16.8	24.6 17.9	26.3 19.1	27.9 20.3	29.6 21.5	31.3 22.8	32.9 23.9
5.25"				10.9 7.9	12.5 9.1	14.1 10.3	15.7 11.4	17.2 12.5	18.8 13.7	20.3 14.8	21.8 15.9	23.5 17.1	25.1 18.3	26.7 19.4	28.3 20.5	29.8 21.7	31.3 22.8
5.50"				10.5 7.6	**12.0** 8.7	13.5 9.8	15.0 10.9	16.4 11.9	17.9 13.0	19.4 14.1	20.9 15.2	22.4 16.3	23.9 17.4	25.4 18.5	26.9 19.6	28.4 20.6	29.9 21.8
5.75"					11.3 8.3	12.8 9.3	14.2 10.3	15.7 11.4	17.1 12.4	18.6 13.5	20.0 14.5	21.4 15.6	22.9 16.6	24.3 17.7	25.8 18.7	27.2 19.8	28.6 20.8
6.00"					10.9 8.0	12.3 8.9	13.7 10.0	15.1 10.9	16.4 11.9	17.8 13.0	19.2 14.0	20.5 14.9	22.0 16.0	23.3 17.0	24.6 17.9	26.0 18.9	27.4 20.0
6.25"					10.5 7.7	11.9 8.6	13.1 9.5	14.3 10.4	15.9 11.4	17.0 12.4	18.4 13.3	19.7 14.3	21.0 15.3	22.3 16.2	23.6 17.2	25.0 18.1	26.3 19.1
6.50"						11.4 8.3	12.7 9.2	13.9 10.1	15.2 11.0	16.4 11.9	17.7 12.8	18.9 13.7	20.2 14.7	21.5 15.6	22.8 16.6	24.0 17.5	25.3 18.4
6.75"						10.9 7.9	12.2 8.8	13.4 9.8	14.6 10.6	15.9 11.6	17.0 12.4	18.3 13.3	19.5 14.2	20.7 15.1	22.0 16.0	23.2 16.9	24.4 17.8
7.00"						10.5 7.6	11.7 8.5	12.9 9.4	14.1 10.3	15.3 11.1	16.4 11.9	17.5 12.8	18.8 13.7	19.9 14.5	21.1 15.4	22.3 16.2	23.5 17.1
7.50"							10.9 7.9	12.0 8.7	13.1 9.6	14.2 10.3	15.3 11.1	16.4 11.9	17.5 12.8	18.7 13.6	19.7 14.4	20.8 15.2	22.0 16.0
8.00"							10.2 7.4	11.2 8.2	12.3 8.9	13.3 9.7	14.3 10.4	15.4 11.2	16.4 11.9	17.4 12.7	18.5 13.4	19.5 14.2	20.5 14.9
8.50"								10.6 7.6	11.7 8.5	12.6 9.1	13.5 9.8	14.5 10.5	15.5 11.2	16.4 11.9	17.4 12.7	18.4 13.4	19.3 14.0
9.00"									11.0 8.0	11.8 8.6	12.8 9.3	13.7 10.0	14.6 10.6	15.5 11.3	16.4 11.9	17.3 12.6	18.3 13.3
E.F. in.	40 ft.	50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	120 ft.	130 ft.	140 ft.	150 ft.	160 ft.	170 ft.	180 ft.	190 ft.	200 ft.

SIZES GIVEN ARE TO THE NEAREST TENTH OF A FOOT

This table supersedes all previous screen image tables

[*Courtesy, Bausch & Lomb Optical Co.*]

INTERNATIONAL PROJECTIONIST

VOLUME V NUMBER 2

APRIL 1933

W. E. EXTENDED FREQUENCY RANGE EQUIPMENT

A. C. Schroeder

MEMBER OF I. A. LOCAL UNION 150, LOS ANGELES, CALIFORNIA

WE hear much about "perfect" sound projection, but every projectionist knows that there are too many variables in the visual and sound reproduction chain to permit of perfect projection. Perfect visual projection has not yet been attained, and the combination process is only just now beginning to reflect the vast amount of development work which has been poured into the refining process. Sound projection need not be perfect to be acceptable, of course, but it must be what might be termed "pretty good."

Every advance made in the art makes the task of everybody in the field just so much more difficult, for once given improved quality, Mr. Cash Customer attunes his ears to that level and will be content with nothing less.

In this connection, the results of an examination by the writer of the new Erpi equipment installed in Grauman's Chinese Theatre in Hollywood, should prove of interest. Projectionists undoubtedly would like to know more about the new-type sound gates which are used, about why the change from the old-style gates was made, and in a comparison of results obtained. The projectors under consideration previously were equipped with the so-called roller gates.

As most projectionists know, it is extremely difficult to pull the film past the exciter lamp beam at a perfectly *uniform* rate of speed. The film, instead of moving at a steady rate of speed moves at a varying rate, and in very bad cases it probably simulates an intermittent motion. This non-uniform film movement is due to the fact that motion is imparted to the film by the teeth of a sprocket. As each tooth engages a hole in the film and commences to pull, the speed of the film is slightly accelerated; and an instant later the movement of the film is slightly retarded. This varying motion of the film causes a form of "flutter," or raspy sound. Due to the size of the striations on the film at the high frequencies, these "highs" are very much more affected by the varying speed than are the lower frequencies. This defect is most pronounced in extended frequency range systems. To overcome this deficiency work was begun on the sound gates, with the result now to be described.

Film Travel Path

In the roller gate there is really no "gate," as we think of it in the usual sense. The film passes over a series of rollers and eventually over the Movietone sprocket, and it is kept under tension all the way. On leaving the lower sprocket of the Simplex head the film passes over a large roller about 1¼ inches in diameter. This roller has a good deal of tension placed on it by a spring, tending to keep it from turning. The film is kept in contact with this roller by a pad roller that bears directly against the film, holding the film tightly against the large roller. This causes the film to adhere to the latter sufficiently to force it to turn and thus keeps the film under tension as it passes through the rest of the rollers on its path past the light beam.

This large tension roller is shown

in Figure 1 at A. Figure 2 shows another view of roller A, revolving on spindle B, which is fixed in the head. Spring C keeps the roller in position and supplies the necessary tension. After passing the beam of light the film encounters one more roller and then goes on to the Movietone sprocket—from which point on the mechanism is the same as it has been in the regular type sound head used heretofore.

This gate looked great and it was thought that it would solve the problem, although it should be stated that it was quite difficult to thread. It was found, however, that the great tension which was placed on the film aggravated the "flutter" introduced by the sprocket teeth. The problem then was attacked from another angle and a gate was produced in which the film was subjected to the least possible tension compatible with the necessity for keeping the film in focus at the gate. Figure 3 shows how this gate looks. The only tension applied to the film is where it passes over the roller A and under the shoes B. This shoe is held against the film by a *light* spring, and I can assure you that this tension is *extremely* light.

At C is the point where the beam

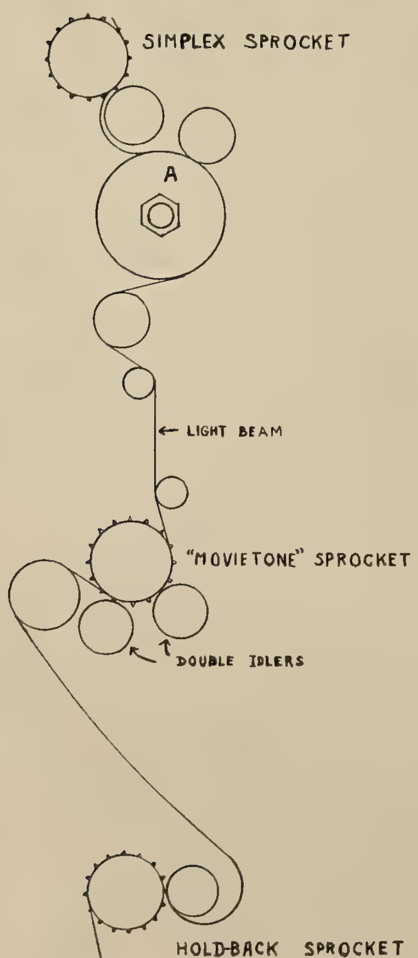

Figure 1

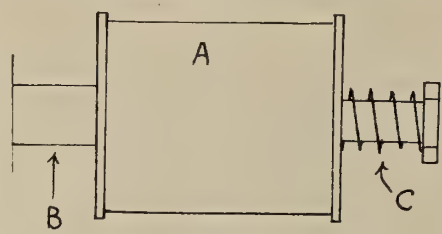

Figure 2

of light strikes the film. D is a curved shoe over which passes the film, which is held against this shoe only by the tension applied at B and by its own stiffness. There are no springs or shoes bearing against the film where it passes through the light beam, as is the case in the usual gates. The film then goes to the Movietone sprocket, against which it is held by a pad similar to the one on the roller above.

Effect of New Gate

The theory relative to this new gate seems to be that since it is impossible, or at least impracticable at the present time, to have the film pass over the Movietone sprocket at a uniform rate of speed, it becomes expedient to produce a sprocket that will impart to the film as nearly a constant speed as is possible, and then to allow what might be called a loop between this sprocket and the point where the film crosses the beam of light. In this manner the film moves past the light very nearly at a uniform rate of speed, then a little further down it wobbles and flutters slightly, somewhat as it does in the regular loops in the picture head, *only in a much smaller degree.*

The "shake" in this so-called loop is so small that it can hardly be seen. In this way the film is moved past the light beam very nearly in the desired manner. From this point it runs on to the hold-back sprocket, just as it does in the present standard type equipment.

Considerable experimenting is being carried on with filters, one being located beneath each p.e.c. amplifier and another on the rack above the '41 amplifiers. Little information regarding these filters is available, and there seems to be no disposition on the part of Erpi to dispel the cloud of uncertainty hovering over their structure and exact function. The equipment overall occasionally is subjected to changes which tend to alter the shape of the frequency curve, there evidently being some question as to what sort of curve reproduces sound in the most pleasing manner.

Getting over to the main amplifier panels, there are two '41's and two '42's, so wired that either the emergency or the regular set can be used simply by throwing a key. The '41 amplifiers have been modified so that the frequency curve has been raised considerably at the high end. From the '42's the sound goes to six '43 amplifiers. These have been modified so that the six amplifiers are properly matched with the '42's and with the output panel, which in turn is far from being the standard 200-A panel. The output of each '43 goes directly to a key before reaching the output panel. By throwing this key the particular '43 connected to it is cut out and an equivalent resistance is put in its place, thus maintaining a proper impedance match in the output. This is important, as the sound is distorted badly when one of the '43's goes bad, or if it is left in the circuit while it is dead.

New Type Speakers

New type speakers are used on the stage and they are so arranged that the voice coils of three speakers are connected in series. The low frequency speakers consist of nine large cones mounted solidly on a huge baffle board, which is fastened directly to the back of the screen. The high frequency speakers are six of Erpi's small 596-A horns. All speakers are fed through filters, which cut off nearly everything above 3,000 cycles for the cones, and

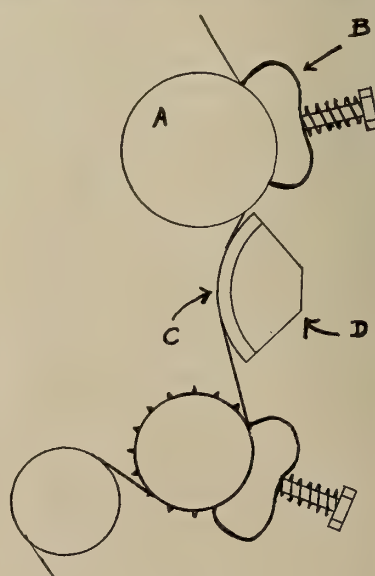

Figure 3

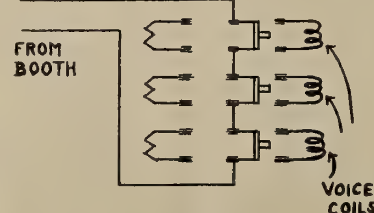

Figure 4

PRODUCTION PROCESS FOR ANIMATED CARTOONS

William Garity

WALT DISNEY STUDIOS, HOLLYWOOD, CALIFORNIA

Always important to the well-balanced motion picture program, the animated cartoon benefited tremendously through a clever utilization of sound accompaniments and, lately, through color. Probably the outstanding motion picture cartoons are the *Mickey Mouse* and *Silly Symphony* subjects produced by Walt Disney Studios, and the accompanying paper by Mr. Garity, originally presented to the Pacific Coast Section of the S. M. P. E., explains in detail the production process at these studios.—*Editor*.

THE method followed in producing a sound cartoon is basically simple. The degree of its success depends almost entirely upon the care and attention given to detail. The picture is built up frame by frame, and any tendency to overlook detail is reflected in the finished product. When one realizes that from ten to fifteen thousand individual drawings are required for each complete production, it becomes clear why such great care must be exercised by all the production departments.

This company (Disney), produces two series of cartoons, the *Mickey Mouse* and the *Silly Symphonies*. In the former, it has been the endeavor to build up definite personalities, not only of Mickey and Minnie, but of all the supporting characters as well. Every effort is made to maintain the same personality of each character in each picture, so as to establish that character in the mind of the public. The *Silly Symphonies* are entirely free from any such limitation, and wide latitude is possible in selecting the subjects. It is the present intent to maintain this series in the realm of the unreal.

The principal difference between producing live-action subjects and animated cartoons lies in the fact that in live action, it is possible to rehearse the characters, see the immediate results, and select the best of several takes for the final product. In producing a cartoon, the director must visualize his action in terms of pen lines, plan his entire continuity, entrances and exits, dissolves and cuts; in other words, do all his editing before a single picture is drawn. His only recourse, when his picture is finished, is to eliminate scenes. But it is not always possible to do this, because a recorded musical score is not as flexible as we often wish it were.

It is necessary to analyze the story and break it down into several scenes, and to distribute these scenes among many individual animators. Experienced men in this field are few and it is necessary, therefore, to maintain a group of apprentices of little or no production value, and to train them in the art of animation so as to be able to develop the organization. These apprentices are required to attend art classes at the studio. The period of apprenticeship lasts for about six months, never less, and often longer.

Very few men qualify in all branches of art. Some excel in characterization; others in mechanical action; others are particularly gifted in animating dialog; others have the ability to give subtle touches to action. They are all classified as to their ability, and as far as possible, are given those parts of the work for which their particular talents are best adapted. Considering the fact that an artist-animator can with diligence produce only five feet of action every eight hours, it is necessary to conserve his time by assigning to him the kind of work he is able to do best.

The first consideration is the story. If the story is good, the results are usually gratifying. The finest music, the best sound recording and the most expert camera work, will never make a success of a cartoon with a poor story. As in live action, the director plays an important part in cartoon production. It is his function to present the story so as to make the most of its strong points and bolster the weak ones. He must visualize the action, build up the situations, and time the action so that nothing is lost. The selection of music and sound effects is his responsibility; and he must supervise the work of each animator in order that his ideas be carried out, in addition to supervising the recording of the music and effects. On him, as in live action, rests the responsibility of the picture as a whole. Next in importance are gags and situations.

Following in the order of importance, are the musical score and sound effects. The music must fit the mood of the picture in order to be effective: if properly chosen, it enhances the value of the story and the action; if improperly handled, it annoys and detracts. In the same way, certain sounds are effective in some situations, whereas the same sound in a different situation would be discordant and annoying. Sound effects should be adapted to the action; a sound effect should never be used unless the eye is conscious of the source of the sound.

The last items in consideration of a good subject are technical perfection, camera work, and sound quality. While we place these items last in importance, they are the ones that cause us the greatest trouble and require constant supervision.

The synchronization of sound to the cartoon is probably responsible, to some degree at least, for their success in the field. This one phase of producing cartoons is probably the least understood by the public, although it is perhaps the simplest part of the problem. Since the advent of talking pictures and the standardization of film speed, the problem became simply one of resolving all musical tempos in terms of the standard speed, and of making a consecutive series of drawings to fit this tempo. In order to do this, certain basic tempos, multiples of the frame speed of the film, have been established. For example, the fastest tempo employed is one beat every six frames, amounting to four beats per second. The total range is from this to one beat every 20 frames, or one beat every 5/6ths of a second.

The Story Department presents the most difficult of all the production problems. When one realizes that a picture must be released every fourteen days, the reason is quite obvious. The men in this department work continuously, developing material for pictures. The first step in the production of a cartoon takes the form of a rough draft of a story prepared by the Story Department.

This story outline is mimeographed and handed to all the animators at a

(*Continued on page* 24)

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everything below 3,000 cycles for the high frequency units.

Figure 4 shows the manner of wiring the voice coils so that they can be thrown out of the circuit should one of them burn out, allowing the other two in that circuit to function, and at the same time cutting-in a resistance equivalent to that of the coil, thus maintaining the impedance match. Undoubtedly other improvements will follow from time to time, until a really high state of efficient sound reproduction is reached. Meanwhile, this latest Erpi equipment is a great advance toward that goal which we can never quite reach—perfection.

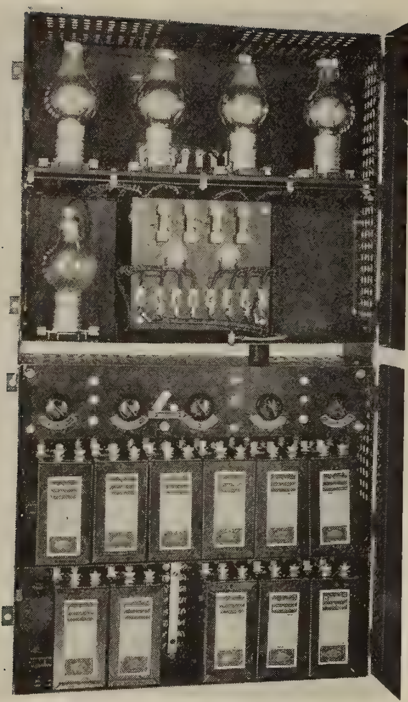


FIGURE 1

Rectifilter unit which meets every demand for power supply by the modern sound picture system

POWER SUPPLY FOR SOUND SYSTEMS

John E. Yarmack

WHEN sound reproducing systems were introduced into the motion picture theatre, several types of amplifiers with low voltage filament supply were utilized. Theatre sound equipment was introduced in a rush, so to speak, and not much thought was given to the development of low voltage power supply directly from the power mains. Naturally, storage batteries were accepted as a source of power supply for the low voltage amplifier filament current. The exciting lamps of 8 or 10 volts also fell into the category of equipment to be powered by batteries. At that time storage batteries were favored because of the common belief that when charged they would not fail during the following twelve hours or so of operation.

Subsequently there arose the question of the necessity for charging batteries at a prescribed rate and during a reasonable number of hours. This procedure often resulted in ill treatment of the batteries, such as the practice of charging them at a higher rate over a shorter time period, overcharging, the failure to renew the electrolyte, and so on. The net results were great inconvenience, needless expense both in operation and in repair charges, and the proved necessity for replacement long before the time originally anticipated.

It became apparent that putting current into batteries by means of a battery charger at intervals and then taking the current out of the batteries during those hours when the sound system was operating required a repeated duty cycle which greatly inconvenienced the projectionist, prevented him from giving the proper attention to other details of his work and, in case of error, provided the theatre with no protection against interruption of the show. Exhibitors and projectionists alike pondered the question of why an efficient substitute for batteries was not forthcoming.

Condenser Developments

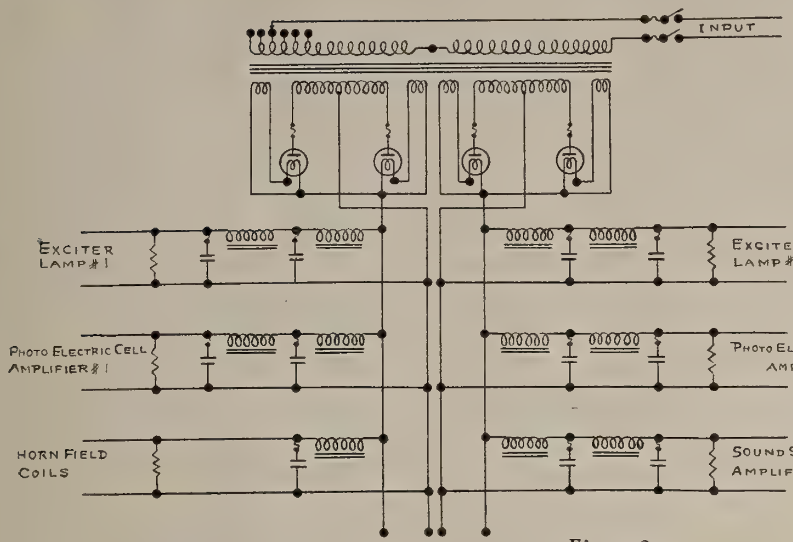
The development of the electrolytic type of condenser gave rise to the logical question as to why it was not possible to combine the battery charger with such condensers at its output circuit, thus paving the way for abandonment of the charger boards and batteries and for the elimination of battery maintenance entirely. Electrolytic condensers do not contain a liquid electrolyte, as do storage batteries, and they may be used over a relatively long period of time without deviating from their original electrical characteristics. Such was the reasoning which led to the development of the RectiFilter, illustrated in Figure 1. This device has been applied to every requirement where batteries were formerly used—sound systems, broadcasting equipment, telephonic and telegraphic installations, etc.—and time has proven it entirely satisfactory for such purposes.

With respect to theatre sound motion picture equipments, there arose the question of a practical and economical means for filtering the current to such a degree that no "ripples" would be audible through the horns when several amplifiers having considerable D.B. gain are connected in tandem. This problem has been solved by splitting the output of the RectiFilter into several circuits, each feeding an individual amplifier, exciter lamp or loudspeaker field coil. Figure 2 shows the subdivision of the filter output into composite filter circuits for one type of theatre sound system.

In adapting this device for theatre sound systems two points of view were considered: (1) the entire sound system as a unit, and (2) the RectiFilter itself as a unit for supplying power at low voltage for the sound system.

From the standpoint of the sound system as a whole, all considerations may be grouped under the following general requirement: the sound system cannot be exposed to the danger of a lack of filtration in each individual RectiFilter circuit. This is particularly important in the case of amplifiers where the audibility of ripples will increase in direct proportion to the increase of volume. Ripples from the exciter lamp, of course, remain at a constant level.

Another important consideration is



SIMPLIFIED SCHEMATIC OF THEATRE SOUND SYSTEM RECTIFILTER

Figure 2

the necessity for safeguarding the sound system input circuits from possible voltage fluctuations at the output of each filter circuit. The voltage regulation at these points has to be within safe limits in order not to overload the amplifiers and occasion distortion or irreparable damage, or to effect the volume level of the sound system as a result of a change in voltage in the exciter lamp circuits. A third important consideration is the fact that the RectiFilter will not affect the sound system through pick-up and hum originating in it. Provision against this latter contingency is made by careful shielding of transformers and individual inductance coils as well as a shielding of the entire unit and also by a pairing and twisting of the wiring itself.

Operating Considerations

From the point of view of the unit itself, the major considerations are, of course, reliability, sufficient assurance that it will have a reasonable life, and costs, both original and operating. In order to insure reliability of the unit itself the instantly removable rectification units and equally easy replacement of the fused condensers offer sufficient assurance that any emergency occuring during the theatre performance can be instantly met. The manufacturers of the bulb-type rectification units guarantee reasonably long service under normal operating conditions. Very often such service approximates 3,000 hours, and their utility is demonstrated by the fact that their industrial value is well recognized in battery charging. Should one of these units fail, it could be replaced simply by pulling out the defective unit and replacing it with the fifth unit which is provided as a spare.

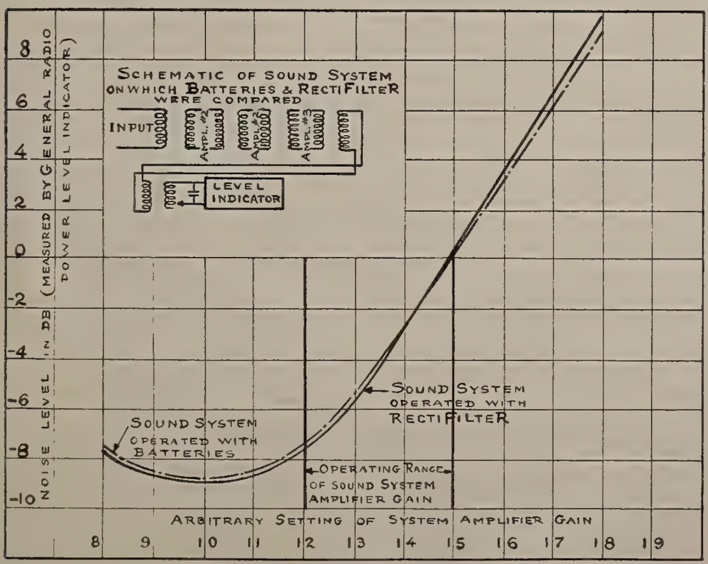
The electrolytic condensers, while comparatively new, have given very satisfactory service to date. The variations in capacitance and power factor on one of these condensers over a period of three years is shown in Figure 3. One of the peculiarities of these condensers is the complete disappearance of the microfarad capacitance at *very low* temperature and its rather fast decrease at low temperature. When the temperature is brought back to normal, the original capacitance of the condenser is regained.

Many RectiFilters have been observed under actual operating conditions for the past few years and their reliability has exceeded the expectations of the designers. The noise level inherent in such units practically duplicates that which is found in storage battery sound systems, as is shown in Figure 4. The cost of this filter unit compares very favorably with that of the original method of power supply (storage batteries), although the size of the RectiFilter desired and the type of batteries used must be taken into consideration in any attempt to establish comparative values. Overall costs, covering both purchase price and operating expense, would seem to favor the filter unit.

The last but by no means least important advantage offered by the RectiFilter is the ease and simplicity with which it can be installed and the fact that it almost completely eliminates the need for maintenance. Since these filter units are installed in the projection room, the saving in wiring and space, as well as the fact that it is always within convenient reach of the projectionist, are very important considerations. With the exception of the occasional need for replacing a rectification unit and still less frequent change of a condenser, these filter units require no maintenance.

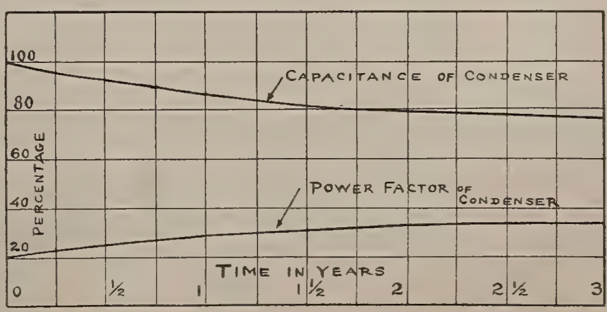
NEW PROJECTION LAMPS ANNOUNCED BY G. E.

An improved line of Mazda projection lamps incorporating major advances has been announced by General Electric Company at Nela Park, Cleveland, O. The results make possible, for the several classes of projectors, screen illuminations which average nearly twice as high as those available two years ago. All of the lamps show improvement in wattage per unit of source area, that is, in concentration of source. Means have



Right: Figure 3

Left: Figure 4



been introduced for the better control of bulb blackening, and a marked advance has been made in the wattage for a given size of bulb.

All lamps are of the 100-volt class, obviating the expense and weight of auxiliary transformers or large resistances used in the past with low-voltage lamps. This is regarded one of the most important practical results of the successful effort toward greater source concentration. It appears that, except on the lower-priced projectors, the practice will become general of using 100-volt lamps in series with a small resistance and in combination with a volt-meter, which will permit the adjustment of the resistance so that the lamp will receive 100 volts on all circuits. Thus, the full advantage of the high light output ,of a lamp of 25-hour life will be combined with satisfactory lamp performance.

The resistance for this purpose is small, light, and inexpensive. and is not to be confused with the large resistances employed with low-volt lamps on direct-current or universal equipments. The volt-meter, also, may be of the most inexpensive type; it need be calibrated for only one point. The life of lamps which are made principally for stereopticon service, where the light requirements are less severe, remains at 50 hours. With this life the auxiliary resistance and voltmeter are less important.

Special Filament Treatment

Special forming and heat treatment of the filaments was developed to reduce warping or twisting of the coils. Thus it became possible to place the coils much closer together. A new type of supporting structure for mounting the filament contributed further to this result. The potential advantages of a biplane construction for the higher wattage equipments of each class had long been known. In the biplane lamp one grid of coils is placed before the other and so staggered that an almost-solid rectangle of light is presented to the lens. But it was not until the new filament treatment and mounting had been perfected that the full advantages of the biplane source could be realized.

Biplane construction is now incorporated in five of the new lamps, in 500, 750, and 1,000 watt sizes. The cost is inherently higher but a higher wattage of filament can thereby be concentrated within the solid angle utilized by the lens system. The construction has, in general, no advantage in lamps of the lower wattages for the several types of projector since their filaments can be disposed in one plane within an area utilized by the optical system. Reduction in bulb blackening has two important results—the light output is maintained at a higher percentage of its initial value, and bulb temperature remains lower through life. Consequently a higher wattage become permissible in a bulb of given diameter.

But two other factors were even more important in accomplishing the marked increase in wattage for a given bulb size. The one is an improved glass which does not devitrify and which withstands higher temperature before softening. The other is the provision of radically higher rates of forced ventilation, accomplished both by greater volume of air and redesign of air passages in projectors for maximum utilization. The result is that the designer of a projector now has the opportunity to choose among lamps requiring only natural ventilation, or moderately forced, and highly forced systems. The super lamps perform satisfactorily only in equipments in the last category.

Permit Men of 306 Seek Legal Determination of Their Union Status; Other Court Cases

PERMIT men affiliated with Local Union 306 have taken action to force legal determination of their status as members of organized labor. An order signed by Supreme Court Justice H. E. Lewis of New York City directs that President William Green of the A. F. of L., William C. Elliott of the International Alliance, and Harry Sherman, president of Local 306 of the I. A. show cause why they should not be permanently enjoined from interfering with the work and funds of a group of permit members of Local 306. The order is returnable May 9.

At present Local 306 has about 1,300 regular card men and some 600-odd permit men. A body of 237 permit men sought and obtained the aforementioned order on the grounds that they have been unfairly discriminated against in the allocation of jobs, that they have not been accorded the same privileges granted to card men, and that they have been forced to pay unfair assessments. Relative to the latter charge, the permit men point to the salaries paid to Messrs. Elliott and Sherman—$20,000 yearly each.

The permit men charge that they are asked to pay 20% of their earnings to Local 306, but this statement conflicts with the fact that permit members of 306 are now paying 12%, the same assessment paid by card men. Boiled down to its essentials, the permit men's case is one in which they ask either to be taken into Local 306 at once as full-fledged card men or have returned to them their entrance fees of $500 per man plus assessments over a period of four years.

Permit-Man Development

Apparently the permit men have secured the desired relief even before the issue comes to trial, inasmuch as the aforementioned labor leaders are forbidden to interfere with the working rights of the permit men or collect further assessments pending trial of the issues involved. A victory for the permit men would make Local 306 liable for more than $1,500,000.

This action is the latest development in the badly muddled permit-man situation which has been developing within I. A. ranks since the introduction of sound pictures. Affiliated local unions, not wishing to swell their ranks unnecessarily as a result of any sudden diminution of available jobs, seized upon the permit system as one which, while subjecting the worker to all rules and regulations of the Union, prevented him from voting and required him to pay a fixed assessment in return for the protection extended.

The last I. A. Convention in Columbus, Ohio, approved a resolution making it mandatory on each Local Union to pay per capita tax on all permit men, the income from whom formerly went into the local treasuries.

KAPLAN WINS STAY

Sam Kaplan, deposed as president of Local Union 306 by the I. A., has won a stay of execution of sentence pending appeal in the case in which he and nine other ex-officers of 306 were found guilty of coercion. Kaplan and one Teddy Greenberg were given jail sentences of from six months to three years in this case, the other defendants being fined. It is expected that the appeal will be argued before the June term of the Appellate Division.

CHICAGO ORGANIZER HELD

Ralph O'Hara, organizer of Local Union 110 (Chicago), was exonerated from all blame in connection with the slaying of Fred Oser, "opposition member of 110, by a coroner's jury which held that O'Hara had committed "justifiable homicide." Immediately following this decision, Chicago newspapers unleashed a concerted attack upon the personnel of the jury and referred to its findings as "politically inspired." Ignoring the findings of the jury, the District Attorney of Cook County, in which Chicago is located, immediately placed O'Hara under arrest on a charge of murder. The defendant, now free on $10,000 bail, will go on trial early in May.

Notice!

INTERNATIONAL PROJECTIONIST

is now located at

580 FIFTH AVENUE

New York, N. Y.

WIDE RANGE: ITS SIGNIFICANCE TO THE PROJECTIONIST

J. S. Ward

DIRECTOR OF OPERATIONS, ELECTRICAL RESEARCH PRODUCTS

THE keen interest displayed recently in the conversion of existing Western Electric Sound Systems to Wide Range operation has been reflected in the numerous inquiries from projectionists as to just what such conversions involve from equipment and operation standpoints. Before going into details, it will be well to stop and make certain that we have got a clear idea of just what is meant by Wide Range sound, for there seems to be considerable misunderstanding of it. Wide Range does not refer in any way to picture projection but involves only the reproduction of sound.

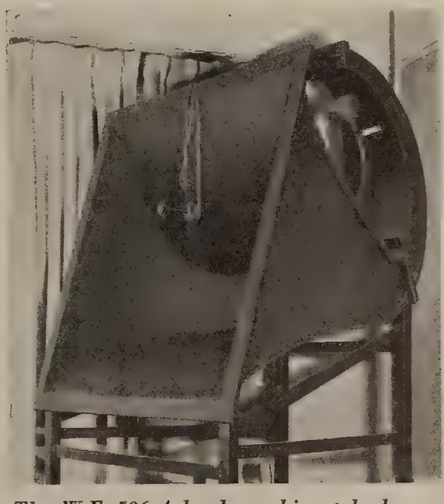
Everyone remembers the first tinny radio sets produced about 1924; voices were understandable but not natural, music could be recognized but lacked the full mellow tonal quality which makes it so enjoyable. The more modern radio set represents a distinct advance; voices are more natural and music more enjoyable. Wide Range sound represents fully as great an improvement over present-day sound picture quality. This improvement is brought about through two means, one involving an extension of the pitch (frequency), range to include all frequencies from 40 to 10,000 cycles, and the other an extension of the loudness or volume range. The former necessitates primarily new loudspeaker units and circuit changes, while the latter requires an ample amplifier capacity to prevent overloading.

No Standardized Process

Because there are several different types and sizes of W. E. sound systems in use and because of the wide variation in acoustic conditions in different theatres, the exact equipment modifications and additions required cannot be standardized. In other words, each conversion must be handled as an individual case, each must be a "tailor-made" job. However, there are certain modifications necessary which are common to all systems and these, together with the principal changes made to meet particular conditions in individual cases, will be described briefly.

Conversion to Wide Range operation means that the system must be so modified that it will be capable of faithfully reproducing a frequency range of 40 to 10,000 cycles and a volume range considerably in excess of that to which we are accustomed. When we say that the system must be capable of reproducing frequencies from 40 to 10,000 cycles we do not mean that it will not go beyond these limits but simply that the reproduction is practically uniform between the limits mentioned and gradually falls off below and above these limits.

Starting with the stage equipment, the broadened frequency range makes necessary the addition of special speaker units to handle the higher and lower frequencies. A selective filter, or "distributing network" as it is called, separates the output of the sound system into three groups or bands of frequencies much as a superhuman traffic cop might separate heavy traffic, sending trucks down one road, passenger cars down another, and pedestrians down a third. Each of these frequency bands is then fed into the group of speaker units designed to handle that particular band. This distributing network "cuts off" very sharply at the limits set, thereby preventing any possibility of overlapping between the bands. It is a compact unit and is mounted on the stage, usually adjacent to the "B" box where the speaker circuits from the projection room are terminated.



The W.E. 596-A loud speaking telephones, designed for reproducing frequencies above 3,000 cycles, as contrasted in size to the large type theatre horn

The higher frequencies (above 3,000 cycles) which have been segregated by the distributing network are fed into the newly developed high-frequency units, commonly referred to by sound engineers as "tweeters" because of the high pitched sounds they produce if they are operated without the horns or speakers which contribute the lower frequencies. They are frequently mounted on a flat baffle near the mouths of the existing horns and are so directed as to give suitable sound distribution of the particular frequencies they transmit.

The middle range of frequencies (from 300 to 3,000 cycles), is fed from the distributing network into the existing horns equipped with 555 Receivers so that these units, which formerly handled all frequencies reproduced, now take care of only the 300-to-3,000-cycle band. The low-frequency range (below 300 cycles), is reproduced by dynamic type speakers mounted in a large flat baffle usually placed directly behind the acoustic screen below the existing horns. Because of the characteristic sound they produce when used without the middle and high-frequency units, they are commonly known as "woofers."

New Sound Aperture

All of the units in each of these three groups are carefully "poled" with each other, which means that they are so connected that their diaphragms all move in the same direction at any given instant. This prevents "feed-back" from one unit into an adjacent one, a condition which would seriously impair the quality. Each of the three groups is also properly "poled" in relation to the other groups.

Of particular interest to projectionists is the introduction of a newly developed sound aperture. The old aper-

ture, together with the guide roller and pad roller assemblies, is replaced by the new unit, which is known as the TA-7260 Aperture. In some types of equipment a new exciting lamp bracket is also employed and unless a KS-6607 lens tube assembly is already in use, one must be provided in each sound unit. The threading of film through the new aperture involves fewer operations. The reduced tendency for wax and emulsion accumulations to form lessens the attention needed in keeping it clean, while such cleaning as is necessary is much more easily and quickly accomplished. In W. E. Universal Base type equipment, it is necessary to replace the 707-A Drive with a 707-B Drive, unless this has already been done.

Where systems incorporating W. E. "D-Spec." attachments are to be converted to Wide Range, it is essential that they be in good condition mechanically. If a hold-back sprocket has not already been installed, it is necessary that this be done, preferably when the units are checked up or overhauled mechanically. Many exhibitors feel that it is desirable to install W. E. 206-type Reproducer Sets to replace the "D-Spec." attachments when the conversion is made.

Amplifier Changes

Where the existing equipment includes 8-B and 10-A Amplifiers, 41-A and 42-A Amplifiers are installed and the 10-A is modified to reduce the noise level. If 8-B and 9-A Amplifiers are in use, they are replaced by a 41-A and one or two 42-A Amplifiers. Additional amplifiers are installed if they are needed to enable the system to handle the increased volume range without overloading. Since several circuit modifications are necessary in the photoelectric cell amplifiers, these changes are made at the factory where the wiring can be done under favorable conditions. Amplifiers in which these modifications have already been incorporated are therefore installed: these do not differ in general appearance from those which they replace. One of the modifications involves the addition of means for equalizing. This is so designed that it can be adjusted within certain limits to give results which will be best suited to the acoustics of the house.

Modernization Features

An acoustic survey made before the conversion is started will indicate what, if any, acoustic deficiencies need attention. Improvement of the sound quality at the mouths of the horns is of little value if the acoustic conditions of the house are not acceptable to begin with.

The mechanical parts of a well designed sound system will render indefinite service if given careful maintenance and if parts subject to wear are replaced as necessary. Because of the rapid advances made in the art, it sometimes becomes desirable for operation or maintenance reasons to replace certain units with equipment of more modern design. For example, advantage is taken in many cases of the opportunity to completely modernize the sound system by installing power units to replace batteries at the time of conversion. These units are reliable and need very little maintenance as compared with the careful attention required to keep storage batteries in good condition. However, such a change, although desirable, is in no way essential to Wide Range operation.

Each improvement in the art of picture or sound projection has affected the projectionist directly or indirectly, usually resulting in making it increasingly necessary for him to exercise care in his work. Wide Range is certainly no exception; it will demand that still closer attention be paid to the operation and maintenance of all parts of the projection equipment which concern sound quality. Since no chain is stronger than its weakest link, neglect of any one part of the equipment will lead to a deterioration in the quality.

While a decided improvement will be apparent after a system has been converted to Wide Range operation, a still further improvment will be realized when all sound pictures are recorded by the improved process. The studios are rapidly meeting the higher standards of theatre reproduction by modifying their recording equipment and improving their processing methods to record the upper and lower frequency ranges which the Wide Range systems will reproduce.

H. I. ARC LAMP ALIGNMENT

Sidney Wein

MEMBER OF I. A. LOCAL UNION 306, NEW YORK CITY

PROPER alignment of all vital elements in an arc lamphouse is a subject which has generated much discussion, oral and written, but has prompted little action looking toward improvement. A high-intensity arc lamp is a very efficient mechanism, but full use of its capabilities is not realized when its operation is hampered by inattention of the projectionist to certain operating requisites.

Considerable light loss is occasioned in a high-intensity lamp for the following reasons: negative carbon out of line with respect to the center of the condensers, and condenser assembly lenses out of line with respect to each other. The accompanying illustrations indicate these deficiencies. In Figure 1, A shows the negative carbon too far to the left; B shows the negative carbon too far to the right; while C shows a perfect arc, the result of proper alignment. A and B sections of Figure 1 show the tail flame out of center, which condition means that the light is out of center with respect to the center of the condensers.

Figure 1

To remedy this condition it is necessary to move the carbon-carrying carriage either right or left in order to directly center the light on the condensers. But, when this is done, the center of the positive carbon is facing the center of the condensers out of true, as is shown in Figure 2.

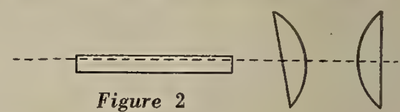


Figure 2

Condenser Alignment

These shortcomings can easily be overcome in arc lamps having negative jaw alignments. In a majority of high-intensity lamps, however, the negative jaw assembly is usually bolted to the lamp carriage by means of insulated bolts or screws. These bolts or screws can be loosened, after which the negative jaw assembly can be tapped over either to the right or left to line up the carbons correctly. When the work is finished, the bolts or screws should be tightened firmly again, a failure to do which will result in the jaws getting out of line again due to vibration.

The alignment of condenser lenses

requires care and attention to detail. The lens on the screen side is usually in a holder that cannot be moved in any direction, but the condenser on the arc side is in a holder that always can be moved back or forth, with respect to the distance between the arc and the front condenser, on a pair of rods or runners. In Figure 3, A indicates condenser lenses which are in line with each other; while B shows the condenser on the arc side out of line with the front condenser. The rear condenser is in a holder that is

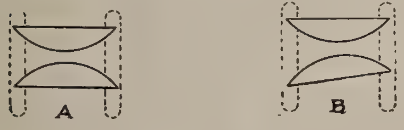


Figure 3

held onto the rods by screws, one on each side. It is well to loosen these screws and, using an aligning tool made from a piece of wire bent in the shape of an ell (L), one can line up first one side and then the other. When both sides are the same distance from the front condensers, the screws are tightened.

The foregoing information may be summed up as follows: The condensers should be in perfect alignment with respect to each other; the negative carbon should be in alignment with the positive carbon, and the center of the positive carbon should be in alignment with the center of the condensers. If these conditions prevail, one can be sure of getting not only the most light but the best light from high-intensity arc lamps.

Occasional adjustments and natural wear combine to wear out the mica insulation on the lamphouse. Periodical checks to establish the extent of this wear are very important in order to prevent possible "grounds" and short-circuits.

HI-HEAT LUBRICANT FOR ALL PROJECTOR ARC LAMPS

A NEW lubricant for projector arc lamps has been marketed under the name of Wilson's Hi-Heat Lubricant. This product has been used with great success by a limited number of projectionists, and the results of these tests indicate that Hi-Heat has very definite superior qualities as an arc lamp lubricant.

Best results are obtained by first thoroughly cleaning the lamp parts with gasoline and a wire brush. It is not necessary to wait until the lamp is cold in order to apply Hi-Heat, which may be applied to any and all parts of arc lamps. It will not burn, gum, or build up in the highest intensity lamp, and it assists in the removal of burnt screws, scored shafts, tight bushings, etc. It quickly cools an overheated bearing. It contains no graphite, acid, abrasive or harmful ingredients of any kind. Distribution is being handled by R. M. Wilson, a member of L. U. 162, at 230 Jones Street, San Francisco, Calif.

S. M. P. E. MEETING MARKED BY FINE PAPERS PROGRAM

ECONOMY in motion picture production and distribution was the keynote of the meeting of the Society of Motion Engineers held at the Pennsylvania Hotel in New York City, April 24 to 28. Registration has been higher at other Society meetings, of course, but the attendance this time was on the whole very encouraging. Those who attended the sessions evinced an earnestness and a desire for solid accomplishment which more than compensated for any deficiency in attendance.

An unusually well-balanced papers program was presented throughout the week. Papers of a strictly technical nature were complemented by various non-technical presentations which afforded the engineers a means for establishing just how their efforts were being received outside their own ranks. A feature of the program was the number of papers which cited the growing influence of the motion picture within and without the professional field.

Space limitations prevent the inclusion herein of the full papers program. Those papers of particular interest to those engaged in the reproduction field are listed herein, in addition to a number of abstracts of a similar nature. Evidence of the refining process which is exerting great influence upon the design and operation of sound-on-film reproducers was apparent in several papers relating to latest type reproducers.

One of the outstanding sessions of the week was that held at Bell Telephone Laboratories. The demonstration accompanying the paper, "Recent Developments in Hill and Dale Recording," by H. C. Harrison of the Laboratories staff, served to emphasize anew the marvelous advances which have been made in disc recording and reproduction. Sound-on-film still has a long way to go to approximate the quality of this disc process, the use of which on a broad scale in the motion industry obviously was discontinued for purely economic reasons. Motion picture patrons really have never heard good sound if they have not heard records produced by this process, and it might be just as well that they do not hear such sound so long as sound-on-film quality remains at its present level. Dr. H. E. Ives repeated his demonstration of an experimental apparatus for the projection of motion pictures in relief, and although he emphasized the fact that commercial application of the system still is remote, there can be no doubt that the basic principles of the art have been established and are being subjected to intensive development work by serious workers.

The Exhibition Session was productive of much interesting material and discussion. "A New A. C. Projection Arc," by Messrs. Joy and Downes of the National Carbon Co., was the first public promulgation of a projection development which bids fair to establish new standards of screen illumination in the smaller theatres which now utilize low intensity arcs. The effect of this new arc is to substitute for the L. I. arc a light of a quality and intensity as to afford favorable comparison with present high intensity arc illumination. This development will be described in detail in these columns at a later date.

Other interesting data contributed at this session came from Mr. F. H. Richardson, who read his paper, "Avoidance of Eye Fatigue," which listed several sources of eyestrain having their origin in unnecessary theatre practices, the remedies for which are so simple as to demand their application. In "Radio City Sound Equipment," Mr. B. Kreuzer gave a complete description of the various equipments in this latest New York City theatrical development.

Projection Practice Report

Another highlight of the meeting was the session devoted to the report of the Projection Practice Committee, of which Harry Rubin is chairman. This report contained a description of a test reel to be used for detecting certain visual and sound projection defects which may be corrected by the projectionist. This test reel, produced jointly by the Committee and the RCA-Victor Co., Inc., comprises 1,000 feet of test film, 500 feet of which is given over to various test objects (targets), for visual projection, with the other 500 feet being given over to various tests for sound quality. The latter section of the reel is re-

corded on both sides, thus comprising in itself 1,000 feet of sound tests. Any projectionist may easily utilize this reel to improve materially the performance of his visual and sound equipment. Prints will be made available to all theatres through the Society of Motion Picture Engineers. A complete description of this reel will be published herein at an early date.

Other phases of the Projection Practice Committee report dealt with an optical alignment tool for projectors; screen illumination in the average theatre as affected by the screen illumination in studio projection rooms, and certain recommendations relative to improved and properly positioned change-over marks on Standard Release Print. This report provoked more discussion than any other paper or report offered at the meeting, the results of which cannot help but be of great benefit to projectionists everywhere.

The sessions were productive of many more papers and reports of more than passing interest, publication of which in these columns will be effected from time to time. As previously observed, the Society is deserving of much credit for sponsoring these sessions in the face of prevailing conditions, the bulk of the praise for which must go to those willing workers who now, as in the past, have served the Society faithfully.

In this connection, mention herein must be made of Dr. A. N. Goldsmith, president of the Society, for his admirable direction of Society affairs within the past year; of Sylvan Harris, editor-manager of the Society; of William Kunzmann, who this year duplicated his fine efforts in arranging for the Convention; of O. M. Glunt, chairman of the Papers Committee, for presenting a finely balanced program; of Will Whitmore, for his good publicity work; of J. H. Kurlander, for his labor of love as Secretary; and, last but by no means least, of H. T. Cowling who as Treasurer probably is most sorely pressed these days.

Abstracts of some of the papers presented are appended hereto:

IMAGE DISTORTION IN PROJECTION AND VIEWING OF MOTION PICTURES

Clifton Tuttle

IN THE presentation of motion pictures there are three reasons why perspective in the screen image which the eye sees may be incorrect: 1. The relation between camera lens focal length, projection lens focal length, and viewing distance may be wrong. 2. The picture may be projected at an angle other than the normal to the screen surface. 3. The picture may be viewed from some angle other than the normal.

The first cause may be considered as

(*Continued on page* 28)

QUESTIONS and ANSWERS ON PROJECTION SCREENS

R. T. Rasmussen

THE appended questions and answers constitute the third in a series of articles on motion picture screens. Emphasis is placed on the fact that this series is not intended to be controversial or to constitute a rebuttal of data on screens from other sources. All information presented herein reflects the results of careful tests conducted by competent workers using every modern testing facility. Comments from readers are invited.—*Editor.*

20. *What is the comparative brightness of various screens?*

To check on the brilliancy of different makes of screens, light tests were made under the auspices of the Screens Committee of the S. M. P. E. by a representative of ERPI at the Paramount Theatre, New York City. Two instruments were used: a Macbeth Illuminometer and a special equipment constructed in the Physics Department of Eastman Kodak Co. The following tables show the results of this test:

Make of Screen	Brightness
Beaded Screens	
Super Vocalite	187%
Da-Lite (beaded)	115
Diffusive Screens	
Chromolite	90%
Ratone	79
Orthochrome	80
Transtone	72
Mandalian Mesh	80
Metalatone	74
Walker	72
Datone	71

21. *What percent of the projected light do various screens absorb?*

(Editors note: Absorption figures ranging from 10 to 29 percent for various types of diffusive screens are supplied by Mr. Rasmussen in answer to this question, but in the absence of data as to how the test figures were obtained this information will not be presented at this time.)

22. *What is the average weekly current and carbon cost for different types of projection lamps?*

The following table shows the average weekly current and carbon costs for different types of projection lamps based on a 7-day week, 9 hours per day, with 5c per k.w. hour being used as an average:

Current Cost	Carbon Cost	Total C. & C. Cost
8.75	3.00	11.75 L. I.
26.00	26.50	52.50 Hi-Low
42.00	28.50	70.50 H. I.

23. *What is a projection angle?*

The projection angle is that angle formed by the ray of light meeting a horizontal line perpendicular to the center of the screen. The average angle of projection in American theatres is 18.5 degrees. Theatres with balconies having not more than 15 rows, usually have a projection angle approaching 20 degrees; two-balcony houses, 30 degrees; three-balcony houses, as high as 45 degrees. The one-floor type of theatre rarely exceeds 5 degrees projection angle, and the stadium type theatre, 8 to 10 degrees.

24. *What is the right size of screen to use?*

The following table shows the sizes recommended by the S. M. P. E.:

Distance—Screen To Rear Row	Size of Screen
75 ft.	11-3 x 15-0
80 ft.	12-0 x 16-0
85 ft.	12-10 x 17-0
90 ft.	13-6 x 18-0
90 ft.	14-3 x 19-0
100 ft.	15-0 x 20-0
105 ft.	15-10 x 21-0
110 ft.	16-6 x 22-0
115 ft.	17-3 x 23-0
120 ft.	18-0 x 24-0
125 ft.	18-10 x 25-0
130 ft.	19-6 x 26-0
135 ft.	20-3 x 27-0
140 ft.	21-0 x 28-0
145 ft.	21-9 x 29-0
150 ft.	22-6 x 30-0

26. *What is a screen image?*

The screen image is the projected film frame as it appears on the screen.

27. *Why is a small screen image brighter than a large screen image?*

A large picture needs more light than a small one. For every square foot increase in the size of the screen, there is a loss in brilliancy. If it is necessary to increase the size of the screen, without changing the light equipment, then it is important to see that the new screen has a reflection factor high enough to compensate for the loss of light caused by the use of a larger screen. The following table gives the relative screen brilliancy for different sizes of screens using the same projection light and distance of throw.

Size	Area Sq. Ft.	Brilliancy per cent	Loss per cent
7-6 x 10-0	75	100	
9-0 x 12-0	108	69	31
12-0 x 16-0	192	39	61
15-0 x 20-0	300	25	75

SOUND EQUIPMENT SERVICING BY PROJECTIONISTS

Aaron Nadell

THERE is a method, or technique, for finding trouble rapidly, the secret of which is simple—doing most of the trouble-shooting, and especially most of the planning and thinking, in advance. The steps taken to find the cause of the trouble following an emergency should follow a prearranged plan and be carried through without hesitation. The method described herein is one that many experienced trouble-shooters adhere to as a matter of course, just as an experienced projectionist will thread up a reel automatically. This method applies to only one kind of trouble—a sudden interruption in the sound. Other troubles require other methods, which will be discussed subsequently.

Two kinds of knowledge are required of the efficient trouble-shooter: (1) a good general idea of the function of every part of the system, what a particular part is, and how it serves its purpose. This information is available in many forms. (2) Detailed information about the individual sound system—such as what wires connect which parts, how those wires run, through what switches and binding posts; just where, in each circuit, a voltmeter or headphones can be applied for testing work, and so on.

This latter type of information, vitally necessary if troubles are to be found quickly, differs in each theatre and often can be found only after considerable effort on the part of the projectionist in "nosing" into every detail of his apparatus. This work cannot be avoided if a projectionist seriously aspires to service his own sound equipment.

Such detailed information can be gathered in several ways. Manufacturer's blueprints often are available, but these cannot always be relied upon to convey an accurate picture of the equipment. Installation difficulties often force the engineer to depart from specifications; or a sound system may have been modified after it was installed. Manufacturer's drawings, therefore, should be checked closely with the equipment, each circuit being examined carefully. A test-buzzer should not be used for this purpose. An ohm-meter, a good high-resistance voltmeter, or a high-resistance pair of telephones are the preferred testing instruments for this type of work. Such instruments pass little current, and their use, unlike that of a test-buzzer, cannot cause trouble. If manufacturer's drawings are not available, the sound system can be checked up without them through the use of an ohm-meter or one of the other aforementioned means.

Advance Planning Necessary

A conscientious service man makes it his business to learn all the peculiarities of any installation which he is called upon to service. The projectionist is much more fortunately situated in that his responsibility does not extend beyond the *single* system which is under his care. All information should be recorded as it is obtained. Wires should be tagged, and wiring drawings should be made. By acquiring and recording every possible bit of data the projectionist actually *can do most of his trouble-shooting in advance.*

Assuming that much information has been acquired in advance, a block schematic, such as is shown in Figure 1, can be drawn up for any sound system. In this drawing one line represents a pair of wires, with details of switches, etc., being omitted. Figure 1 shows only the speech circuits. Figure 2 shows, in addition, one of the power circuits—the "A" circuit—and hints at others which were not included because to do so would defeat the essential simplicity of such a drawing. However, the projectionist can easily draw a schematic of all the circuits in one sound system by using colored pencils.

The cause of trouble may lie anywhere in a sound system—it may be anything from an open switch to a short-circuited wire. The first requirement is not to find out *what* the trouble is but *where* it is, to be able to put one's finger on the block schematic and say, "The trouble, whatever its nature, is here." Trouble can be located in two ways: (1) by observation, and (2) by the application of suitable test instruments. Observation naturally is the first step.

Every sound system is equipped with meters, and most of them with signal lamps. In addition, the filaments of vacuum tubes themselves act as signal lamps, indicating whether normal filament current is passing through them. The first step in finding trouble is a rapid observation of all these evidences of normal operation. A routine for checking meters, signal lamps, tube filaments, etc., should be established in advance, so as to enable checking as rapidly as possible and to avoid confusion and the possible overlooking of significant indications. Periodical check-up of the entire equipment is an important method of preventing trouble.

If one of the meters, signal lamps or tube filaments indicates abnormal functioning of any circuit in the system, the trouble must be run down within that circuit, the method for doing which will be explained later. We may assume for the moment that inspection

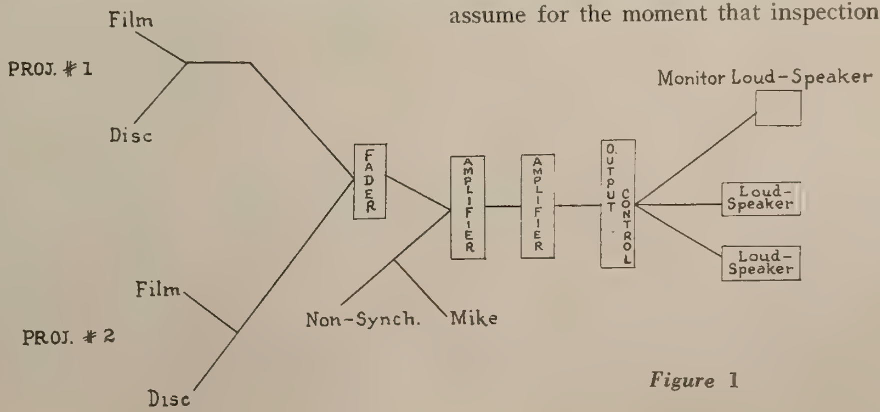


Figure 1

has given no indication of where the trouble may be and that a second step in the technique of trouble-shooting is necessary. Referring to Figure 1, assume that No. 1 projector disc reproduction was in use when the sound was cut off. By applying a pair of headphones first to the binding posts of No. 1 disc reproducer, then to the film-disc switch, then to the fader input, and so on, the sound could be traced down through the system. This method of locating trouble would work perfectly, but it is by no means the fastest. The fastest way to test for trouble is to test not to *find* but to *eliminate*.

Referring again to Figure 1, the headphones might be applied first of all to the fader output. If sound is heard there, one-half the system is eliminated from suspicion. The trouble can only be between the fader output and the speakers; and there is no need to make any further tests in the other half of the system. Likewise, if sound is not heard at the fader output, the amplifiers, the speaker control panel, and the speakers themselves are cleared of suspicion.

Limiting the Test Area

The next step would be to take that half of the system which is suspect and divide it in half—by testing at its central point. Close adherence to this process confines the location of the trouble to some extremely small area, to some one amplifier or part, in which the exact nature of the trouble speedily can be found even if the amplifier or part cannot be temporarily eliminated from the circuit.

If procedure is planned in advance, and the headphones are kept handy, this test requires only half a minute, often less. The chief work of preparation is to locate, on a block schematic like Figure 1, suitable points at which binding posts or terminals are readily accessible for headphone testing. It is easy to see that if the trouble-shooter, after each such test, has to stop to wonder where the phones should be applied next, or has to investigate whether the circuit can easily be reached at the point he decides upon, the same process may require five minutes instead of thirty seconds. Moreover, time is sometimes saved by departing from the schedule of dividing in half the suspected portion of the equipment at each successive step.

For example, after checking the input to a certain amplifier and finding sound, it may be desirable to go on to listen at the output of the horn control panel. Then, too, the output terminals of an amplifier may be directly alongside the input terminals, in which case only a few seconds more would be required to check the output also. Advance planning and preparation will determine such matters.

The process described up to this point seldom does more than *locate* the trouble; it does not tell what the trouble is. Always bear in mind the fact that it may not be necessary to both locate and repair the trouble in one continuous operation. An amplifier or other part often can be eliminated from a system and be investigated at one's leisure, while the show goes on. But if it is necessary to find the cause rather than the location of the trouble, modifications of the foregoing two steps are applied.

Assuming, for example, that an amplifier is found to be at fault. The first thing to do, just as in the case of the system as a whole, is to check the power supplies. This may be done with a voltmeter which is applied to the binding posts through which power is led into the amplifier. If the power supplies are found in proper order, the speech circuits must be run down, those within the amplifier being divided in half by headphone test at some central point, and in half again by a second test, and so on. When this has been done, the power supply at that point can be tested with a voltmeter, if the headphone test has not already indicated the transformer or other part at fault.

Power supplies are tested with a voltmeter, rather than with headphones, but the same general procedure of testing to *eliminate* rather than to *find*, which is applied to speech lines, applies to them. The difference is that power lines are very often equipped with meters or signal lamps of some sort, consideration of which will save much time by confining the necessity for testing with a portable meter to a very few places at which trouble should show up almost immediately. Just as a procedure for testing speech lines can be worked out in advance, based on a schematic like Figure 1, so can a procedure for testing power lines be based on a complete schematic, drawn in colors, only an outline of which is given in Figure 2.

These preparations may seem to be unduly elaborate, and the experienced trouble-shooter does not use them. But if practical experience be lacking, adequate advance planning will take its place until it has been acquired. Also, mapping out a routine in advance is in itself a valuable experience.

"Reflected" Troubles

A burned-out fuse is a common trouble. But suppose that when a new fuse is inserted it burns out immediately? One trouble has been found, yes: the sound has stopped because a fuse has burned out, but this trouble may be merely a reflection of a short-circuit somewhere else. In the same manner, a burned-out power transformed, discussed previously in this series, may be only a reflection of a short-circuited tube or a filter condenser. When such a "reflected" trouble is found, processes very similar to those already described must be adhered to in locating the *cause* of the trouble.

In the case of a fuse, for example, it is difficult to locate a "short" unless various portions of the circuit are disconnected, one after another, until the defective portion is located and removed, after which the fuse will no longer blow. Opening circuits with a soldering iron takes time, and here

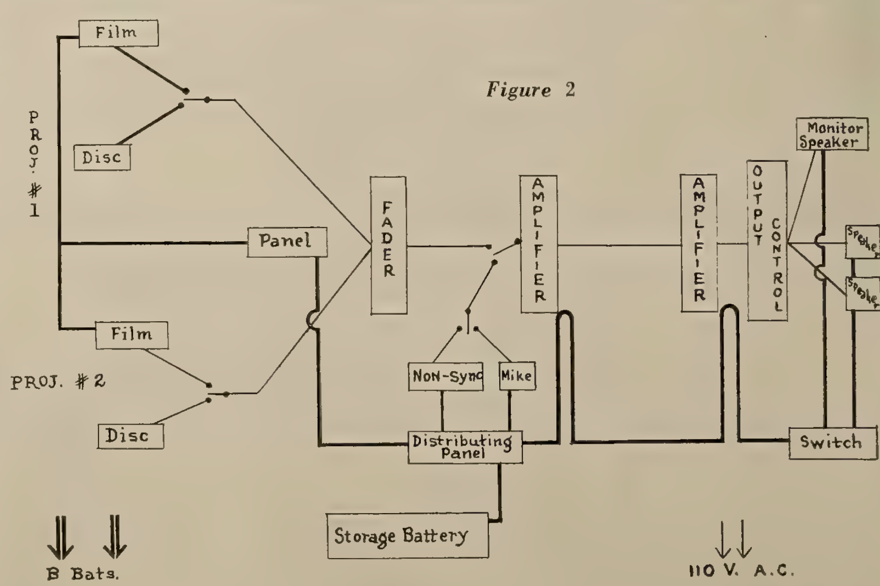


Figure 2

THE PRIVATE LIFE OF THE ELECTRON

Clyde W. Shuey

MEMBER OF I. A. LOCAL UNION 150, LOS ANGELES, CALIFORNIA

FOUR men in golf togs were lounging by the drinking fountain at the eighteenth hole. It was hours before show time; and the "Old Master" was puffing at a half-smoked cigar and absent-mindedly figuring how much his last salary cut would have amounted to at compound interest in fourteen years, when the conversation switched to electricity. "We don't know what electricity is but only what its effects are."

The "Old Master" was wide awake. "As a matter of fact that isn't strictly true. We do have evidence that allows us to make some pretty shrewd guesses as to just what electricity is. You have all heard of the electron, of course, and there has been some little confusion as to just what constitutes a flow of electrons and what constitutes a flow of electric current. Of course there is no distinction: A flow of electrons is a flow of electric current, whether this flow be through a metal conductor, a gas, or a vacuum. There is some controversy as to just what an electron would look like if it were possible to hold it up and look at it, but it will help greatly to understand it and its action if we discuss it and its relation to the atom.

Major Atomic Theories

"As early as 1704, Newton probed the secret of the atom and concluded that atoms were small particles in the shape of cubes, spheres, tetrahedrons and, perhaps, irregular-shaped solids. Four other major atomic theories propounded since Newton's time are unimportant to us except to note that the next real advance was made by a man named Boscovich some fifty years later. Another fifty years and Dalton again revised the conception of the atom; but the most important step came more than a hundred years later in 1913 when Bohr[1] formulated his famous atomic theory and gave the world the new atom model which has been so useful in explaining the laws of physics and chemistry.

"In brief, the Bohr theory states that the atom is made up of a central nucleus or proton. Around this nucleus revolve the electrons, each having a unit negative charge. The nucleus itself must have one unit positive charge for each electron that it attracts. Any other properties that the nucleus may have, we can ignore in our discussion. If we examine the ninety-two elements that make up the known world, we find that the first of these, hydrogen, consists of atoms having a single electron revolving about a proton with one unit positive charge. The second element is helium, having two electrons and, naturally, a nucleus with a positive charge of two units. This continues on until we reach uranium with ninety-two electrons revolving about a nucleus with a positive charge of ninety-two units."

"If there is an attraction between the electrons and their nuclei, why don't the electrons of an atom go crashing into their nucleus?"

The "Old Master" rolled his cigar to the other side of his mouth;—"The easiest way to answer that question is to avoid it by referring to our solar system. Call the sun the nucleus of an atom. Call our earth an electron. The earth revolves about the sun in a manner similar to that in which the electron revolves about its nucleus. There is an attraction between the earth and the sun which may be expressed by Newton's *law of universal gravitation* which states, 'Every body in the universe attracts every other body with a force that is proportional to the product of the masses of the two bodies and that varies inversely as the square of the distance between them.' "

"Of course, there are more than two bodies in our solar system. If we consider the sun and eight planets, we have a large model for the atom of nitrogen which consists of a nucleus and eight electrons. We know that the planets do not collide with the sun. The full reason for this may be found in any good text on astronomy. The electrons do not collide with their nucleus for a similar reason.

"The forces within the atom are small, as the size of the atom is small. On the other hand, when the size of the atom is considered, the forces existing between its elements are relatively large. This is most readily explained by referring to Newton's law, as previously stated, regarding the square of the distance between the elements under consideration. From this we see that for a given condition we have a certain force existing between two bodies which is increased four times when the distance between them is halved. If this distance is decreased to one-fourth its former value, the at-

[1]The last theory advanced by Schroedinger in 1925 is not widely known. As far as the author has been able to find, it is more of an advancement of the Bohr theory rather than a new departure.

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again much time can be saved by testing to eliminate rather than to find. One-half of the circuit can be disconnected at the first test, another half at the second test, and so on. Three or four such tests will nearly always reveal the location of the "short." Any other procedure might require a dozen steps.

Dual Amplifying Systems

In many projection rooms, portions of the sound equipment are duplicated as an emergency precaution. There are, of course, two projectors, sometimes three; and double amplifier systems are commonplace in good theatres. "Emergency" switches may offer opportunities for much faster testing than do headphones, and, in addition, provide the advantage of restoring sound immediately. Utilization of these natural advantages should be included in the first step, previously described, accompanying the preliminary check of meters and signal lamps. When more elaborate preparations are required, the exact procedure is a matter for individual judgment. For example, trying the non-synchronous source of sound (Fig. 1), is an excellent way of testing the entire system beyond the input of the first amplifier, and this step may eliminate all that apparatus from further consideration. The procedure to be followed in such matters must be worked out on the basis of the individual projection room.

In the same way, the entire procedure described herein must always be applied with reference to individual conditions. It is offered here not as a rigid rule, which can never be applied to this type of work, but as a guide. The experienced trouble-shooter applies his experience to individual conditions as he finds them. The simple fact is that nobody can find trouble in a system without knowing that system (except by pure luck). First, know your system, and then apply this knowledge to a prearranged systematized routine of finding trouble.

(*To Be Continued*)

traction is increased sixteen times. The distance between the electron and its orbit is unbelievably small. For this reason it would take an enormous force to pull an electron from its nucleus, if this force must act at a measurable distance from the electron as would be the case in any laboratory experiment.

Effect of Heat

"There is one way in which the atom is easily affected. When heat is applied to the atom, the motion of the electrons is increased. They revolve faster and faster as the temperature rises, and since the centrifugal force is greater, as in the case of the flyball governor, the size of the orbit is increased. It is readily apparent that if we can increase the size of the orbit enough, we can reach a point where the electron can free itself from the restraining influence of its nucleus.

"If there is an external force acting on it, such as the plate of a vacuum tube, it will be attracted in the direction of this force. If there is no external force in its vicinity, it will very likely fall back into the same atom when its energy is spent, and providing no other electron has replaced it.

"Since some elements have a great many more electrons than others, we might reasonably expect that the heavier atoms would more easily lose electrons than the lighter ones; and this is partly true. But the arrangement of the orbits themselves seem to have some influence upon the ease with which an electron can escape from its atom. This means that some elements which might be forecast from the known arrangement of their atoms, would emit electrons at normal temperatures. Others would become emitters upon application of light alone. A great many elements would emit electrons upon the application of the proper amount of heat. As an example of well-known elements having large numbers of electrons, we might mention thorium, the active material of the thoriated filament, with ninety electrons, and radium with eighty-eight."

"How many electrons can an atom lose?"

Current Producing Properties

"I suppose you are wondering how it is possible to get a current of several hundred amperes from such a small unit as the electron. It would probably be impossible for an atom to lose more than one electron without an actual change in its nucleus,—but let us consider the flow of current in a piece of copper. The atom of copper has twenty-nine electrons. If we suppose only one of these electrons capable of freeing itself, we would have one electron for each atom in the copper. This electron would jump from one nucleus to another, if the voltage of a battery or other source of potential were applied. Surprising as it may seem, this would furnish enough electrons from a cubic inch of copper for a current of two hundred and forty-four thousand amperes (244,000 amps.), for a space of one second.[2]

"In the conduction of electricity through a wire no means exists to tell in which direction it flows. It is true that it is possible to measure the amount of current in arbitrary units as it is possible to tell when it starts, when it stops, and when it changes its direction of flow; but there is no way to tell in which direction the original flow began. In order to talk about it and work with it, it was necessary to assume that it flowed either from positive to negative or from negative to positive. About the beginning of the 19th century somebody[3] decided that electricity must flow from positive to negative. In the case of two possibilities, the chances of any guess being right are 50-50, and as is so often the case with guess-work, he got it exactly backwards.

"The discovery of the 'Edison effect,' or flow of current in a vacuum, proves the guess to have been wrong. In the vacuum tube the current must go from the source of supply, which is the hot filament or cathode, to the plate which, when cold, has no means of supplying electrons. Most of the rules and formulas of the electrical engineer were developed during the last century before this discovery and naturally are based upon *the false assumption that electricity flows from positive to negative.* To change them now would not only be confusing but as difficult as changing our domestic system of weights and measures to the metric system.

"The electrical engineer prefers to ignore the new discovery and go on as before; the radio engineer accepts the new order of things and disregards the electrical engineer as far as possible; but the man who runs into difficulty is the man who must combine the two or work with both. For him all sorts of makeshift schemes have been devised. Like all makeshifts, they are very unsatisfactory. There is only one sensible thing to do and that is to have a full understanding of the action of the electric current and learn to apply it equally well to a dynamo or a vacuum tube."

"What is the electron itself? From what is it made?"

"Those are hard questions to answer. Your guess is as good as mine. They have some of the properties of particles and some of the properties of waves. It is my own opinion that they are rotating charges of electricity, whirling upon their axes much as our own earth rotates. This would make a tiny magnet of each electron."

The Molecule

"Where does the molecule fit in? Doesn't it have something to do with atoms?"

"Perhaps it would be well to make brief mention of the molecule. It is of very little interest to the man who deals only with electricity, but one should understand the relation between it and the atom.

"The molecule is made up of atoms.

[2]This figure is an approximate value calculated from data given in the Hodgman and Lange "Handbook of Physics and Chemistry." It is derived by multiplying the number of molecules in a cubic inch of copper by the charge on a single electron.

[3]This somebody was very likely Henry Cavendish. There is no direct proof but the evidence points to him. Probably a number of men contributed to the idea.

Exposition

CONCISE and forceful is the following estimate of what is wrong with present conditions in the motion picture industry, as gleaned from a routine report of the Motion Picture Section, U. S. Department of Commerce. The writer of the following lines may not know it, but the fact is that in two short paragraphs he has summarized the major problems of the film industry.

"Motion picture attendance in . . . . continues to hold up well, but dealers in equipment complain that replacement business is still at a very low ebb despite the fact that in many theatres equipment now in use is rapidly approaching an age where it can no longer be used with any degree of satisfaction.

"Of considerable assistance in maintaining attendance at motion picture theatres still open, has been the policy of restricting competition, especially in the smaller centers, and cutting down the prices of admission by about 25 per cent. The high average quality of pictures shown during the past winter has also helped, as the public is becoming more and more critical and discriminating with the shrinkage of their funds available for entertainment."

There may be only one atom in the molecule, as is the case with pure copper; but again there may be two atoms in the molecule, as in the case of oxygen; or even three, which in the case of oxygen, is no longer oxygen but ozone. The atoms of different elements combine with oxygen to form oxides, with chlorine to form chlorides, and so on with a great many others. It is interesting to know that these molecules have motions of their own in the case of a liquid or a gas and even to some extent in the case of a solid, as, for example, rubber and spring steel. This motion increases with rise of temperature. In the case of water heated to the boiling point, the molecules attain such a speed that they actually jump clear of the water in the vessel, in which case it is necessary that they have a velocity great enough to overcome the surface tension which we all know is sufficient to float a pin or a water bug.

"The air itself is composed of molecules of gas (oxygen, nitrogen etc.), and it is possible to measure their velocity, which has been found to be about 370 yards per second in a straight line. As this compares very closely with the velocity of sound in air, it seems quite probable that the velocity of sound depends upon the average linear velocity of the molecules in the transmitting medium."

The "Old Master" gathered up his clubs. "Let's pitch a coin to see whether we play more golf or go home. Lend me a coin somebody. I left my money at home."

[Note: For the convenience of those readers who may desire to pursue further readings on the topic of Mr. Shuey's article, the following references are appended: *The Universe Around Us*, Jeans; *The Structure of the Atom*, Andrade; *Encyclopedia Brittanica; Scientific American*, 139, 9, July, 1928, and 146, 296, May, 1932; *Science Monthly*, 33, 550, December, 1931, and *Science*, 73, April 24, 1931.]

MACY CO. REORGANIZED

MACY ENGINEERING CO., manufacturers of public address equipment located at 1,451 39th St., Brooklyn, N. Y., is now under the direction of Messrs. Haddaeus and Blumenthal, who are also officers of Ditmas Electric Co. A complete reorganization of the engineering and sales departments of the Macy Co. has been effected, and the complete new Macy line of p.a. equipment will be announced in a catalogue which is now on the press. The legalization of beer, in addition to general improvement in business conditions, has lent impetus to the demand for public address outfits, according to Mr. Haddaeus.

Review of
FUNDAMENTALS OF SOUND

The probability that projectionists will shortly extend their activities to include the servicing of sound picture equipment has generated renewed interest in the fundamentals of sound recording and reproduction. Each month in this department will appear material which will serve this interest.

III. Elementary Electricity

IN some instances the electrons are so strongly attracted to their corresponding protons that it is impossible to move them by means of the potentials we are using. These substances are known as "non-conductors." In various stages between what are termed "conductors" and "non-conductors" are materials in which the electrons are comparatively hard to move, but which will carry a current depending upon the amount of electrical pressure applied. All conductors offer fairly low "resistance" to the flow of electric current. Metals as a rule have comparatively low resistance; while non-metallic substances such as porcelain, wood, glass, etc., offer a very high resistance to the flow of electric current.

The resistance offered by a wire is in proportion to its length and cross-section. That is, a wire of a certain material which is twice as long as another wire of the same diameter and material will have twice the resistance. Two wires of the same material and of the same length will offer different resistances to the flow of current if the areas of their cross-sections differ. If one wire has one-half the area of cross-section as the other, it will offer twice the resistance to the flow of the current.

The flow of an electric current in an electrical circuit is very similiar in its action to the flow of water in a water system. To have a flow of either water or electricity, it is absolutely necessary to have first a pressure. Without pressure there is never any flow. In electrical circuits the pressure is called "potential," and it is measured in units called *volts*. Since the unit of potential is called a volt, potential itself is quite often called *voltage*.

If a pressure is applied to water in an open pipe line by means of a pump, the amount of water which will flow through the pipe depends on two things: (1) the pressure, and (2) the size of the pipe, which determines its resistance to the flow of water through it. If a certain pressure is applied to the pipe line, a certain flow of water will result. If this pressure is doubled, the rate of flow will be doubled; and, on the other hand, if the pressure is cut in half, the rate of flow will be halved. In like manner, if the size of the pipe is doubled, the rate of flow will be doubled; and if the size of the pipe is decreased, the water will flow at a decreased rate in direct proportion to the decrease in the size of the pipe.

The same thing is true of electrical circuits. If the current through an electrical circuit at a certain voltage is measured, and then the voltage is doubled, the current reading will also be doubled. It can also be observed that, provided the pressure is kept constant, and, instead, the size of the conductor is varied either in length or in cross-section, the current will change, also. Increasing the length of the conductor or decreasing its cross-sectional area will decrease the current, since this will increase the resistance. All other things being equal, if the resistance of a circuit is cut in half, the current will be doubled; and if the resistance is cut to one-third of its original value, the current will be trebled, and *vice versa;* that is, three times the resistance will result in one-third of the current, etc.

These facts were first presented as a definite rule by a man named Ohm, which resulted in the use of his name as applied to the unit of resistance. The unit of current is known as the "ampere." *The value of an ohm of resistance was so chosen that it would require an electrical pressure of one volt to force an electric current of one ampere through it.*

If any two of the three factors men-

NEWS and VIEWS

A collection of random thoughts and some not so random; fact, fancy and opinion pertaining to the projectionist and projection matters. The free-for-all forum.

Score One Against the Poor Stagehands

PROBABLY the invention of a stay-awake-at-night columnist, ever desperately on the hunt for a gag, is the appended commentary on the cooperativeness of our colleagues, the stagehands:

The other evening Arch Selwyn was telling how "Forsaking All Others" was doing business until the bank holiday came along. Despite the fact that the show has a solvent Bankhead in it, Archie had to work out a plan to pay off the actors and keep it running.

"But what about the stage hands?" he was asked. "They're pretty tough. How are you going to take care of them?"

"I'm not worrying about them," answered Archie. "I've spoken to them and they've agreed to take gold."

F. H. Richardson Calls A Few Spades

FROM F. H. Richardson comes the following blast directed at those who seek to corrupt projection nomenclature, a standard of which has been F. H.'s aim for, lo, these many years:

Dear Jim Finn: May I make a suggestion? As you know, in the earlier days a terrible mix-up was put over in the matter of nomenclature in the then new industry. As you also know, I was the first to raise a holler about these things, starting things off by coining the term "projectionist." For fifteen years I have "fit a good fight" in an attempt to reform nomenclature.

Now, sound men are foisting two or three misleading and rather silly names on us for use in designating what is really one thing, namely, a SOUND PROJECTOR.

May I ask that you in I.P. "can" the terms "horn," "loudspeaker," etc., and speak of the thing only as a sound projector. I'm not seeking any credit, mind you; I only want the right, sane and sensible term adopted and used. Erpi and the sound men will, of course, object strenuously. Well, Jim, let 'em. They really are not running the whole dad-binged industry and maybe it would be just as well to let them discover the fact.

For "Rich" we have the highest respect, not only because it was he who for years fought a single-handed battle to force respect for projectionists and to make the latter respect themselves and their work, but also because when he sets sail for a given port he never lets up until his ship is safely in. On this matter of nomenclature we agree with "Rich" in general; but the foregoing yell about what constitutes a "sound projector" fails to win our complete agreement.

A horn, or loudspeaker, certainly is a sound projector, but the use of the former terms has become rather general as a result of the necessity for differentiating between various units of the entire system. Personally, we should call the projector itself and any attachment thereon a "sound projector." Horns and loudspeakers are just that, although we prefer the latter term. Overall the equipment certainly is a "sound projector," but facility in description compels different names for different units.

Come again, "Rich."

California Bill Concerning Improved Conditions

OF interest to projectionist organizations is the following transcript of a bill introduced recently in the California Legislature and referred to the Committee on Capital and Labor:

An act to regulate certain working conditions of operators of motion picture machines in theatres and motion picture houses; and providing a penalty for the violation thereof.

The people of the State of California do enact as follows:

SECTION 1. Every operator of a motion picture machine, when operating such machine in the operating room or booth of any theatre or motion picture house, shall devote his time and attention to that work; he shall not leave the operating side of a motor-driven machine nor engage in unnecessary conversation with anyone, nor in any other work in the booth, while operating a motion picture machine. Any violation of the provisions of this act shall be deemed a misdemeanor, and the person found responsible for such violation and through whose act, order or negligence the violation is caused shall be punishable by a fine of not less than twenty-five dollars.

What's the Matter With the Picture Business?

NEW LONDON, Conn., is the home of one of the most progressive projectionists we ever met, and his name is Joseph Bliven. Electrician, mechanic, p.a. specialist, refrigerator specialist and projectionist—Bliven is all of these rolled into one. Just now he is busy acting as instructor for the classes which the New London Local is holding (You guessed it—on sound system servicing). Joe wields a smooth pen when he is in the mood, as is indicated by the following letter which he penned to his local newspaper:

I notice in your paper a very mis-

REVIEW OF FUNDAMENTALS OF SOUND

(*Continued from page* 21)

tioned above (voltage, current, and resistance), are known, the third factor may be found from one of the following equations:

$$E = RI,\ I = \frac{E}{R},\ and\ R = \frac{E}{I}$$

where E represents the voltage, R the resistance in ohms, and I the current in amperes.

If a valve is placed in the pipe line, the flow of water can be restricted. In the same manner the flow of electricity can be restricted by placing a resistance in the circuit. If the resistance is made variable, the current can be changed at will. A variable resistance of this type is known as a *rheostat*.

If the water pipe is tapped at various points at different distances from the pump, and the water pressure is measured between these points while water is flowing through the pipe, the pressure of the water will be found to vary in proportion to the distance of these points from the pump measured along the pipe. A resistor carrying an electric current and tapped at various intervals has a similar effect, that is, if the voltage is measured between one end and the different taps, the voltage will vary from one point to another. A resistor used in such a manner is known as a potentiometer. Potentiometers of the simplest variety are usually made of "resistance wire" wound on a form and are provided with a sliding arm which permits contact with the resistor at any point throughout its length. With such a

(*Continued on page* 26)

leading article about the closing of theatres in Cleveland, due, according to this article, to the unions refusing a cut in wages.

It probably would interest your reading public to know that it is not the wages paid to union men that causes a shutdown, this being mostly used as an excuse for such actions.

It is like the electric wiring in buildings being blamed for fires that are caused by other agencies. On the average the payroll of union employes in theatres is about six per cent. or less of the total operating costs. And this money paid to employes, stays in the community. Also, remember, *theatres sell only on a cash basis.*

Inflated Film Rentals

The inflated cost of film rentals and theatre rents are the most costly items, if not the real strangulation of the theatre. Elaborate theatres, built at fabulous costs, beyond all sense of proportion, with no consideration of the ultimate taxes, interests or mortgages, and depreciation, that are always hovering over such inflated values, bring a burden that no industry can bear.

But this general waste of money at the beginning is because of the expectancy of luring the public into them, on account of their lavishness and irrespective of the merits of the show being presented. The public, after a few times of being stung, realizes that it is not getting its dollar's worth of entertainment (the lavishness of the theatre does not make the entertainment, it only helps create an atmosphere), and patronage inevitably declines.

Improved Shows Impossible

The cost of operation, on account of the first waste, makes it almost impossible to improve the entertainment; and to "pass the buck," the blame is invariably put upon the union men employed in the theatre.

If the public only knew the real work and the knowledge necessary, with the time and expenditure for the knowledge that motion picture projectionists have to undergo, and the responsibility they have to assume, they (the public) would say that they were underpaid when compared with other lines of work.

JOSEPH E. BLIVEN.

Common Sense Way Out In Wisconsin

IN Beaver Dam, Wisconsin, an attempt was made recently to void a general city ordinance which requires a projectionist for each operating machine. The Common Council voted 12 to 2 to retain the ordinance following the reading of a report by the Board of Public Works which vigorously upheld 2-men shifts. The opinion of the Board of P. W. would be of interest to this department, which has stoutly resisted 1-man projection shifts.

"–The One and Only Projectionists' Guide"

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GLENN HUMPHREY
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Cleveland, Ohio, Local 160

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CHARLES L. FINK
Cheyenne, Wyo., Local 647

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Boston, Mass., Local 182

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• Your capable and courageous handling of various topics merits high praise. All projectionists should get behind you with unlimited support.

LAWRENCE KATZ
Harrisburg, Pa., Local 488

PRODUCTION PROCESS FOR ANIMATED CARTOONS

(*Continued from page* 9)

gag meeting, which is held every two weeks for the purpose of discussing future pictures. The discussion is held within the limits set by the Story Department, as outlined previously. Two weeks following the discussion of the story, the animators hand to the Story Department suggested gags and situations for the particular story. The Story Department then makes a complete study of these and prepares a definite story outline in the form of a scenario. Then a conference with the director and the musician, who are to produce the picture, at which the director is made acquainted with the story and assisted in preparing the continuity so as to preserve the original ideas and situations.

In this conference is included the "set designer," known as the "layout man." It is his function to prepare rough sketches of the complete scenes, depicting the atmosphere of the action, keeping in mind the movement of the characters. From these sketches the background sketches are prepared and, finally, the finished backgrounds. In making the backgrounds, it is necessary to leave clear such portions as will later be occupied by the animated figures. The layout man must assist the director in maintaining good continuity of background, so that when camera angles are changed, the resulting background change will be smooth.

The director and the musician, at the end of this conference, have a very definite idea of the story, situations and gags to be used; and the approximate footage of film that will be needed. The story is then layed out on a layout sheet, as shown in Fig. 1. Each "box" (or small rectangle) represents a bar of music. How much of the picture is to be shown during each bar depends on the tempo at which the music is to be played. Referring to Fig. 1, each box, starting at 1, covers 48 frames of action, the tempo being indicated at 4-12. While working on the sheet, the musical director writes his preliminary master score. In some cases, when it is desired to use a certain piece of music, the director is required to adapt the action to the music. At other times, the action requires entire freedom from musical limitations, except with respect to tempo. In this case, the musician must compose music to suit the action. It is by means of the layout sheet that the entire problem is resolved, the action made to suit the music, and the music written to suit the action.

The director and the musician work hand-in-hand, measure by measure, frame by frame—each one trying to adjust his particular problem to meet the demands of the story. When the

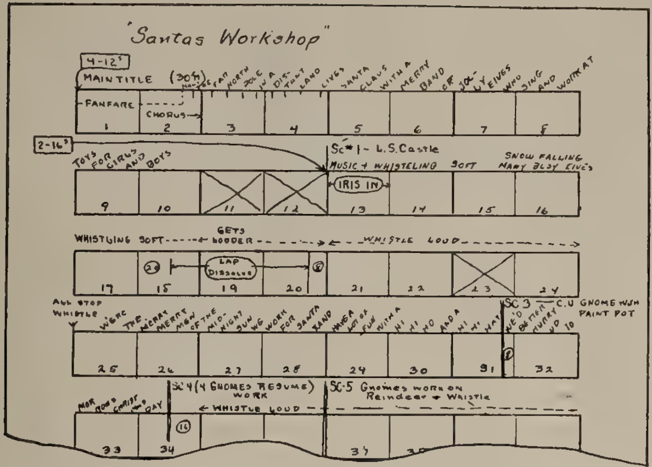

FIGURE 1

Typical layout sheet used for planning an animated cartoon

layout sheet is completed, the director has his picture completely laid out to the frame, and the musician his master score to the note. Slight changes may later be made in order to accommodate the exigencies that may arise when the pictures are animated. It is everyone's desire to preserve the layout sheet as final, but necessity requires that it remain flexible.

The production schedule shown in Fig. 2 is next prepared. As will be noted, this schedule contains the scene numbers, the footage of the scene, the name of the artist, and a description of the action to take place: scene 24, the first scene on the sheet, is allocated a footage of 14 feet, 10 frames to be drawn by the artist, Ben, and to be a medium close-up showing a permanent wave. As soon as the schedule is completed, the director fills out an exposure sheet, describing in terms of frames of picture the continuity of the action, exactly on what frame the sound effects will occur, and what the nature of the sound will be. The tempo of the action is also shown on the exposure sheet, which is prepared with the assistance of the musician, who simultaneously marks on his master score the exact position of sound effects.

The director, when preparing the exposure sheet, definitely instructs the animator as to the nature of the scene to be depicted, the exact footage the scene should occupy, and the tempo of the music to be played during that particular sequence. The director also explains to the animator in great detail the relation of his sequence to the rest of the story, points out the particular gags or situations that are to be developed, and supplies the animator with the necessary information concerning the preceding and succeeding scenes. The animator is also furnished with a background sketch which serves as his stage setting. It is the animator's function to visualize the scene in terms of pen-and-ink lines, and to produce a series of progressive drawings of the scene that will tell the story and the ideas incidental to it. The animator is quite limited, due to the fact that the musical tempo, as well as the footage of the scene, is fixed. He will sometimes find it necessary to shorten or to extend his bit of action to complete his sequences more effectively. In this case, he confers with the director; and if the latter approve such a change, the musician is consulted, who must rearrange the score to suit the change of footage. Such a procedure is avoided as much as possible, obviously.

As the animator makes his progressive drawings, he numbers them serially, recording them at the same time in the columns provided on the exposure sheet, in the order in which they are later to be photographed. The animator confines his drawings to a field approximately 7 by 9 inches. At the lower edge of the drawing paper outside the field are two perforated holes. These control the reg-

TITLE OF PRODUCTION: "SANTA'S WORK SHOP" -2- PICTURE No. U.S. # 7 STARTED COMPLETED

FOOTAGE	SCENE NO.	ARTIST	DATE STARTED	DATE COMPLETED	DESCRIPTION OF ACTION
14-10	24	BEN			M.C.U. PERMANENT WAVE.
4-14	25	KING		M.C.U.	SANTA PICKS UP MAMMA DOLL
15-6	26	"		S.A.25	GEN: TEACHES DOLL TO SAY "MAMMA" O.K.'
37-2	27	"		S.A. 25	M.C.U. SANTA INSPECTS MAMMY DOLL AND AIRPLANE.
7-4	28	BEN			M.C.U. PLANE KNOCKS TOYS OFF SHELF.
11-14	29	"			L.S. TOYS START TO MOVE.
18-6	30	"		PAN	M.L.S. BAND AND SOLDIERS MARCH.
35-10	31	"		PAN	M.C.U. VARIOUS TOYS IN PARADE.
12-	32	GERRY			M.L.S. TOYS START INTO BAG (TRUCK)

FIGURE 2

A production schedule in which appears all pertinent data

istration of the drawings. The animator's drawing board is provided with an insert of glass, under which is placed an electric light. On the edge of the glass insert nearest the animator, on the top surface of the drawing board, is placed a bar containing the registering pins, on which the paper is fastened. All drawings, including backgrounds, are made only when the paper is engaged by these pins. The paper used has a hard finish, and is very light in weight, so that tracings of images is facilitated.

Each animator has an "in-between" man or assistant, and generally two apprentices. In order to conserve the animator's time, he makes drawings of only the extreme action, and makes a finished model as a guide for his assistants, who fill in the intervening drawings. For example: if the action require a walking character, taking 16 frames for a complete step, the animator makes drawings Nos. 1, 8, and 15, while his assistant, or "in-between" man, makes drawings Nos. 2 to 7 inclusive, and 9 to 14 inclusive. The assistant then hands the drawings to the apprentices, who fill in all the necessary detail.

(*To be continued*)

FUNDAMENTALS OF SOUND REPRODUCTION

(*Continued from page* 22)

device any desired fraction of the impressed voltage can be "tapped off" by simply moving the sliding arm.

Production of Electricity by Contact.—All electricity is basically the same, no matter how produced. Static electricity gains its name from the manner in which it is produced, *i.e.*, by rubbing together two insulating materials, such as a glass rod and a piece of silk. When two different materials are rubbed together and then separated, they are both found to be electrically charged. One of the materials is charged to the opposite polarity from the other. This is caused by the electrons of one of the substances being rubbed off and gathered by the other. Since the materials are insulators, the charge does not flow off and they remain electrically charged. The charge is therefore said to be "static." If touched by another substance, they will discharge to it a portion of their charge. If touched to the earth, they will give up their entire charge. Electricity produced in this manner has very little value because of the inefficiency of its generation, although it may be very annoying when produced where it is not wanted, as in the case of belt-driven machinery, or in nature in the form of lightning.

Production of Electricity by Chemical Action.—Electricity can be generated by chemical means. Examples of electricity generated in this manner are shown in the use of (so-called), dry batteries, wet batteries and stor-

age batteries. Two different substances, such as copper, zinc, carbon, etc., immersed in a dilute solution of acid, constitute an electric cell. The two solid substances are called *plates*, and the acid solution is called electrolyte. The plates extend above the solution for making external connections. If the two plates are connected together by means of a conductor, a current will flow through the connection. The energy is furnished by the action of the acid on one of the plates, which is eaten away as the current circulates. The current will continue until a plate is entirely eaten away, or the active element of the acid is used up. In order to renew the cell it is necessary to replace the consumed plate and the acid solution. A common example of such a cell is the ordinary "dry" cell with zinc and carbon plates. The acid solution, instead of being liquid, is a paste formed by impregnating absorbent material with the acid solution. If the direction of current through such a cell is reversed, neither the acid nor the plate will be restored, so that such a cell cannot be used as a storage battery. This type of electric cell is called a *primary cell.*

In certain types of cells the original condition can be restored, after the cell has been discharged, by forcing current through it in the opposite direction to that in which it delivers current. In such a cell neither plate is eaten by the acid, but the chemical compositions of the plates change, and, although the acid is weakened as the cell discharges, it is restored to its original strength when the cell is recharged. This type of cell is known as a *storage cell.* The commercial name, "storage battery," is derived from the fact that several cells are arranged together to form a "battery" of cells. A storage battery does not actually store electricity, but stores energy by chemical means which is readily changed to electrical energy when the proper external connections are made to the battery.

Production of Electricity by Rotating Machinery.—Electricity can be produced dynamically, *i.e.*, from motion, and this method is always used when a large amount of electrical power is desired. It is produced in this manner by means of rotating machines called "generators" or "dynamos." In order to understand how electricity is produced by such a machine it is necessary to know something about the relation between electricity and magnetism.

In the discussion of magnetism it was stated that a magnetic field surrounded a magnetic pole, and that this field consisted of imaginery lines of force which extended from one pole to another. If a loop of wire is placed in the field in such a manner that some of the lines of force pass through a loop, nothing occurs as long as the loop is held stationary and the magnetic field kept at a constant strength; but, if the number of magnetic lines of force which pass through the loop of wire is changed, a voltage will be generated in the loop in proportion to the change in the number of lines through the loop in a second of time. The number of lines of force which pass through the loop can be changed by changing the position of the loop with respect to the magnet or by varying the strength of the magnetic field; but, if the position of the loop is changed without changing the number of lines of force through it, no voltage will be generated.

If the loop is closed, current will flow in the loop whenever a voltage is generated in it. Thus we have the prerequisites for electric power, namely, current and voltage. If a loop of wire is rotated in a magnetic field in such a manner that the number of lines of force through the loop is continuously changing in number, an alternating current is generated. In order to change the alternating to direct current a mechanical device known as a "commutator" is used. The production of electric power by generators will be discussed later.

[NOTE: *Next month will be presented a discussion of alternating and direct currents.*]

S. M. P. E. MEETING OFFERS FINE PROGRAM

(*Continued from page* 16)

an irremediable optical defect, but the amount of difficulty introduced by the last two causes can be controlled by proper theater design. A demonstration of the two latter shortcomings was given with the purpose of contributing toward the establishment of limiting values for the guidance of architects and theatre owners.

HISTORY OF ANIMATED CARTOONS

Earl Theisen

THE history of animated drawings is older than motion pictures themselves. The earliest methods of showing motion by animated drawings dates back to 1832, which was long before photography was a practical art. The first cartoon using photography and made for the screen was shown in 1906 and was made by J. Stuart Blackton for Vitagraph. Another series of cartoons was made in 1910 by Winsor McCay, which have been generally remembered and claimed to be the first motion picture cartoons.

The cartoon vogue started with Bray and Hurd with their cartoons made in 1913. The first motion picture cartoon patent was granted to J. R. Bray in 1914. The first cartoon series was the famous Col. Heeza Liar. The first cartoons in color and sound are mentioned, as well as the more recent cartoon producers. Their present methods and systems were contrasted with the systems used by the early cartooners.

SOUND RECORDING AND REPRODUCING USING 16 MM. FILM

C. N. Batsel and J. O. Baker

THIS paper deals with the various problems involved in the application of sound to 16 mm. film and points out the advantages of the particular type of film which was chosen. There are two general methods of obtaining 16 mm. positives, the direct and indirect. The direct method involves the recording of sound directly to a 16 mm. negative and the obtaining of a 16 mm. positive by either the contact printing or reversing process. The indirect method considers the various ways of obtaining 16 mm. positives from 35 mm. film.

A discussion is given on the prob-

(*Continued on page* 29)

W. E. MAINTENANCE RECORDS

Careful operation of the sound equipment at the Broadway and Rivoli Theatres, Albert Lea, Minn., contributed to establishing a new low cost maintenance record. During 1932 the Broadway did not require a single replacement. The total replacement at the Rivoli for the year was a set of guide rollers costing 86 cents. The average weekly cost per theatre during the year was .827 cents. Both houses have Western Electric equipment.

lems involved in printing and in reproducing 16 mm. sound.

AVOIDING UNNECESSARY EYE SHOCK

F. H. Richardson

THIS paper points out several sources of eye strain to theatre patrons having their seat in entirely unnecessary theatre practices and avoidable errors in the films themselves, and points out very simple means by which such errors may be eliminated.

The intent of the paper is to bring errors of practice which may be avoided sharply to the attention of both theatre men and producers, to the end that they be eliminated, the enjoyment to the theatre patron increased and the eyesight of theatre goers relieved of unnecessary shock and strain.

SENSITOMETRIC CONTROL IN THE PROCESSING OF FILM

Emery Huse

THIS paper includes a treatment of the following subjects: (a) the general application of sensitometry in the processing of motion picture film; (b) the sensitometric equipment and methods used in commercial practice: (c) the sensitometric control of the development of negative, positive and sound track films.

"MORGANA" COLOR PROCESS

J. A. Dubray

THE "Morgana" is an additive color process. Each successive picture frame is analytically photographed through a red and a blue-green filter alternately. The conventional color filters wheel, has been replaced in the camera with an oscillating element which brings the proper filter in position between lens and film for each exposure. Regular panchromatic reversal 16 mm. film is used. The normal photographic speed is 24 picture frames per second, though other speeds can be used.

During projection, the alternation of the picture frames at the aperture is varied from the conventional, inasmuch as for each two successive frames run forward, one is run backward, or in reverse, in the following progression: frames 1-2; 1-2-3-4; 3-4-5, etc. The result is that, although the film is running at both feed and take-up sprockets at a linear speed of 24 frames (1 2/3 feet) per second, 72 frames are alternating at the projector's aperture during the same length of time, each picture frame being projected three times on the screen. This accrued projection speed eliminates color flicker and greatly reduces color fringing.

A conventional filter wheel rotating in front of the projection lens at a speed of 2160 r.p.m., synthetically produces the impression of color during projection.

EXPERIMENTAL APPARATUS FOR PROJECTION OF MOTION PICTURES IN RELIEF

Herbert E. Ives

AN EXPERIMENTAL demonstration apparatus is described for projecting motion pictures in relief by application of the principle of the parallax panoramagram. A series of 32 posed still pictures is made by the use of a large diameter concave mirror forming an image on a transparent concave ridged screen, which in turn is imaged on lantern slide plates. Positives from these negatives are mounted on a slowly rotating disc in the slide plane of a projection lantern. A flashing mercury lamp illuminates

each picture as it comes into position. The projected image is received upon the back of a translucent convex ridged screen. When viewed from the front, the moving picture changes its appearance with the observing position, and exhibits stereoscopic relief.

THE PRE-SELECTION OF "TAKES" FOR PROCESSING

David W. Ridgway

DESIRED "takes" are pre-selected from rolls of film shot on production, only takes required for printing being developed. Undeveloped "out" takes are reversed, spliced together, and later used for printing of "dailies." The methods of "breaking down" the pre-developed negative, necessary precautions, and the economies effected, are described in detail.

A NEW "HIGH FIDELITY" SOUNDHEAD

F. J. Loomis and E. W. Reynolds

ALL components of this RCA-Victor equipment are mounted on a single casting, which simplifies manufacture and materially aids installation. All required power supplies are readily interchangeable on this unit. The use of precision ball bearings throughout provides a construction which is trouble-free and has very long life.

The disadvantages attendant upon the use of a stationary soundgate of the pressure-shoe type are eliminated by a rotating gate which has very low mechanical resistance to motion. As an indispensable adjunct of the freely revolving gate, it was necessary to develop and apply a new rotary stabilizer. The combined gate and stabilizer insure a constant film speed which reproduces sound having a total absence of annoying ripple, which is necessarily present in all sprocket-fed sound reproducers.

The exciter lamp, definitely located laterally, is easily adjusted and locked in vertical position. The optical system is sealed against dirt and oil seepage. The condenser lens is readily accessible for cleaning and is a part of the very compact phototube unit. A shield is provided for the phototube transformer which prevents electrical pickup, and this shielded assembly is so mounted in the main case that it is protected against mechanical vibration, oil and moisture. Conveniently located locking plates provide quick and permanent adjustment of the pad-roller supports.

Threading of film through the soundhead is made extremely simple and easy, due to the special arrangement of parts. A framing knob is conveniently located on the motor shaft for rotating the sprockets manually. A direct connected worm and gear arrangement is used for driving the soundhead. It has been necessary to use materials of the highest grade and all parts have been made to withstand heavy duty in the field.

STANDARDIZATION IN THE S. M. P. E.

Lloyd A. Jones

THE evolution of standards proposed by the S. M. P. E. is traced from the time the Society was formed down to the present. Dates of adoption of certain important standards are given and in some cases the scientific communications on which the standards have been based have been mentioned. Some attention is also given to the various procedures followed in the adoption of standards.

DISTORTION RESULTING FROM SPROCKET HOLE MODULATION

Edward W. Kellogg and Herbert Belar

THAT constant recording speed should be sought in sound recording and reproduction has been recognized throughout the history of the art, but standards of performance have usually fallen far short of this. Especially have the speed variations due to sprocket tooth action failed to receive the consideration which their harmful effects warrant. This is due to imperfect understanding of inherent limitations and to the fact that the injury to sound quality is of a kind which may easily be ascribed to other causes.

An analysis of the loss of true tones and production of spurious tones, as a result of speed modulation at sprocket hole frequency, is given.

A recorder in which not only are disturbances of this kind eliminated, but all speed variations reduced to a minimum, has been available to the film recording industry for several years. Film phonographs, re-recording machines, and projector sound heads of which the same is true are now also available.

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MONTHLY CHAT

OUR hat is off to the sound equipment people for the excellent merchandising job they have done in the theatre field. Exhibitors who wouldn't think of buying a projector part until the old one wore down as thin as a dime, and who could never see the necessity for an overhauling job on a head, have gone completely loco about the new extended frequency range equipments. Sound apparatus that has operated less than three years, in many cases, is exchanged (with respectable cash, to boot) for new extended frequency range equipment—and without a whimper. The answer lies in the fact that sound picture apparatus has been properly merchandised to the exhibitor—projection never has been. For the latter condition, the projectionist himself is largely to blame.

Mr. Projectionist now will certainly have to be on his toes every minute, for the reproduction of frequencies up to 10,000 cycles means more than attention to the running projector; it means careful attention to maintenance requirements and an insistence upon every part being in good order. By the way, has anybody a suggestion to make as to what provision can be made for cleaning the film? Unclean film means no high frequencies, and possibly perfectly terrible sound.

THE idea of a six-hour day and five-day week reads very well in print, but if any such plan is to be tied in with a liberalization of the anti-trust laws, then labor certainly will be the loser. No anti-trust laws would invite centralization of power, with a small group being able to control the destinies of millions of workers. Labor should proceed cautiously before endorsing any plan for a reduced working day and week which embodies any change in the anti-trust law.

MORE than 300 sound picture equipments are now being serviced by projectionists. The figure would be 1,300 or more if projectionists had displayed any initiative. Sound equipments are no longer a mystery, and every projectionist organization has at least one member who is competent to oversee servicing operations. It isn't entirely a case of projectionists vs. sound equipment companies, as many independent servicing companies have been formed. *Now* is the time to get this work.

INTERNATIONAL PROJECTIONIST

VOLUME V NUMBER 3

MAY 1933

SOUND EQUIPMENT SERVICING BY PROJECTIONISTS

Aaron Nadell

III

NO SOUND, the condition described in the last installment of this series, is generally the easiest of all troubles to locate. By comparison, the cause of low volume is sometimes extremely difficult to isolate. The headphone tests by means of which complete loss of sound is traced through the system, as previously described, are of little value in the case of low volume; they are useful chiefly when one knows exactly what normal volume from each amplifier or other part should be.

If an output meter is available, every amplifier or other part can, of course, be calibrated in advance, and the system then run down with the output meter exactly as, in the case of no sound, the system is divided up and run down with the aid of headphones. But the more common method of finding the cause of low volume is that of first, checking power supplies; second, substituting parts; third, using headphones in a manner to be described, and, fourth, again substituting parts.

In most cases low volume will be found to be due to some fault in the power supplies. The initial procedure, therefore, will normally be the rapid routine check of all meters, signal lamps, etc. If this reveals nothing, such substitutions as can be made quickly will be in order. The emergency amplifier, if there be one, may be switched in. If the loss of volume is not too great, it may be advisable to wait for the change-over and check the results from the other projector before proceeding further. The non-sync. volume may be tested, etc.

Headphone Test Limits

If such substitutions as can readily be made reveal nothing, a telephone test may follow. This will be the normal procedure if the routine meter inspection thoroughly accounts for all the power circuits. When that is not true, the third step may be a check, by means of a portable voltmeter, of the power delivered to every part of the system.

The headphone test for loss of volume is not always accurate, since it involves an estimate of what the volume of any given part of the system should be. The procedure used for complete loss of volume cannot safely be followed. On the contrary, the headphones should be applied first at the source of sound—the disc reproducer or the output of the photo-cell transformer or amplifier. (The photo-cell current itself will not, in most cases, be strong enough to operate the headphones.) Beginning at the source of sound, volume may be traced step-by-step to the loud speaker. At each step the nature of the intervening apparatus and its normal effect upon volume must be considered. Thus, an attenuator may be expected to have less volume at its output than at its input end. Reducing volume is the function of an attenuator. A volume-controlling fader will function in the same way. An amplifier, on the other hand, should have more output than input volume.

So much is simple; the difficulty accompanying this form of test lies in estimating whether the attenuator has

removed too much volume, whether an amplifier has added enough. Therefore the same headphone test, made of the system when there is no trouble, will constitute valuable experience for tracing of this kind. But the value of such experience is rather limited. It is difficult to remember just what the volume at any given part of the system sounded like a month ago. The headphone test will therefore be of little value when the loss of volume is not great; but it should readily reveal, even to the inexperienced, a drastic loss of power in any one portion of the system.

In the event the headphone test for loss of volume does not locate the trouble, more elaborate substitution of parts may be necessary. Tubes are the easiest parts to change. If this in turn yields no results, it may in some cases be necessary to borrow replacement amplifiers or other parts until the guilty portion of the circuit is revealed by substitution. The latter is an extreme measure which will very seldom be required. In practice, most cases of low volume will probably be traced to insufficient power supply and will therefore be revealed readily by meter inspection or the test voltmeter. In those instances where the reason for low volume is traced to an unknown defect in some amplifier or other part, the internal circuits of the amplifier or other apparatus must be run down, very much in the same way as the sound circuit as a whole.

Sources of Hum

Hum in the sound differs from most other troubles in that it can often be identified merely by listening to it. The first step, therefore, when hum is heard or reported is to listen carefully to its nature, leaving the projection room, if necessary, in order to hear the trouble as it appears in the stage speakers, uncomplicated by projection room noise.

Advance preparation for curing hum includes familiarizing oneself with the sound of the various common forms of hum, until one is able to recognize most of them the moment one hears them. For this purpose the more usual hums may be created artificially at a time when no audience is present. Sprocket-hole and dividing-line hum are, of course, easy to create and are distinctive enough to be identified readily. Hum of line frequency can be produced by removing some of the condensers from the filter pack, or by any of several ways that will readily suggest themselves. A multi-frequency reel or record will enable the projectionist to familiarize himself with the sound of many frequencies, and thus to distinguish easily between a line hum and a commutator ripple, or to identify any special frequencies that may be present in the projection room, such as the 720-cycle current used in some types of W. E. motor speed controls.

Two classes of hums are sometimes very difficult to run down—commutator ripple and hums of the power line frequency. Both may have many origins.

Commutator ripple requires either finding the offending commutator or finding the point in the sound system at which the disturbance is picked up. If there are many motors in the vicinity of the projection room, the latter may be the easier and quicker resource. In nearly every case, the most sensitive circuit of the system will be at fault; that circuit which has the most amplification behind it is, generally, the photo-cell circuit. Beginning at the most sensitive line, four experiments are possible. The circuit—unless it carries speech—can be filtered by connecting condensers across it. Its ground arrangements may be modified. The position of the wires may be changed. If the wires in the circuit are parallel, a twisted pair may be substituted for them.

If the effect of each experiment upon the disturbance is carefully noted, sufficient light will usually be thrown upon either the nature or the location of the pick-up to make a complete cure possible when ordinary common sense and a moderate acquaintance with the elementary laws of electricity are applied. In cases where the offending commutator can be found, repairing it, filtering it with condensers, or, lastly, modifying its ground connections, should end the trouble. Nearly all of the above applies to hums of the power line frequency, with one important exception. In the case of hum of power frequency the pick-up may be internal if the line power is supplied to an amplifier or other part. One not uncommon cause of line frequency hum will be found in loosened laminations of the core of a power transformer.

The varieties of hums, of their causes and cures, are very great. Orderly procedure becomes proportionately difficult. To review: the first step will normally be to attempt to identify the nature of the disturbance by listening to it. Hums of mechanical origin, such as "motor-boating" due to sprocket holes out of line, are often promptly identified and cured. Hums of apparently electrical origin are traced down largely according to their frequency. Hums of very common frequency, such as that of the power line, or that of an ordinary commutator, are more obstinate to deal with:—they have innumerable possible causes and many potential cures must be tested; rapid repair is quite frequently impossible.

One temporary remedy for hum that has been much neglected is to lower the volume as far as possible. The majority of theatres play their sound a great deal louder than is necessary. In many theatres sound can be cut in half without the slightest loss of intelligibility. (Often intelligibility gains through the decrease in reverberation.) Drastic reduction of volume will therefore often prove a good temporary cure for an obstinate hum.

Sources of Noise

Noise, like hum, can sometimes be identified by its sound. The rasping, scratching noise caused by poor contact is perhaps the commonest form of this trouble. It is hard to find because the poor contact may be anywhere in the entire system. Elimination is the readiest test—check of substitute amplifiers where available, check of the other projector, check of the non-synch or announcing sources, for example.

If substitution yields no clues, a systematic search of the possible sources of loose contact may be undertaken, beginning with the most probable. Rheostats and volume controls often cause this trouble. They are easily checked by rapping them and listening for noise. The monitor speaker will respond audibly when the guilty contact is disturbed. Tubes

P. A. C. Executive Changes

TWO important changes in the executive personnel of the Projection Advisory Council have been announced by President Thad C. Barrows. James J. Finn, of New York, has accepted a temporary appointment as executive vice-president, succeeding P. A. McGuire, who resigned this post because of the press of business duties. M. D. O'Brien, assistant supervisor of projection for Loew Theatres, Inc., and vice-president of L. U. 640 (Long Island, N. Y.), has been named secretary to fill the vacancy occasioned by the retirement of Laurence Jones.

Messrs. O'Brien and Finn, together with Harry Rubin, treasurer of the P. A. C., constitute a special steering committee which will devise plans looking toward expansion of the Council to be submitted for approval to the regular midsummer meeting of the Council to be held the last week of July in New York City.

may be shaken, to discover if the fault lies in their socket connections. If the trouble is not revealed by these efforts, systematic replacement of fuses, which sometimes become noisy, and inspection of soldered connections, which sometimes deteriorate, may be necessary. In some exceptional cases the cause of such noise is found only after prolonged investigation, but in most instances inspection of rheostats, volume controls, B or C batteries, if used; tube sockets and similar likely places will turn up the cause of the difficulty without much delay, even if substitution offers little or no help.

Noises of other kinds are so numerous and have so many possible causes that common sense and reasonable electrical knowledge will prove far more useful than any procedure that can be outlined here. A few of the commoner causes may be listed: microphonic tubes, dirty sound track, scratched sound track, loose exciting lamp, loose optical assembly, defective resistor—especially of the "grid leak" type—amplifier insulation weakened by heat or oil, accumulated dirt resulting in a high resistance short-circuit, excessive vibration of the projector; pick-up from arc feed contacts, from marquee flasher contacts, or from a sparking commutator.

As in the case of hum, noise can be reduced temporarily by lowering the volume.

Defective quality cannot commonly be detected by listening to the monitor—a check upon the quality delivered by the screen speakers should be a part of any periodic inspection routine. The most common cause of poor quality is loss of the higher frequencies, which results in sound without richness of detail—sound in which instruments cannot readily be identified—in which voices lack something of full personality. In the majority of instances defective exciting lamp focus will be found responsible.

Fundamental Principles

Imperfect functioning of the exciter optical system will also result in loss of quality; and if the condition persists after the exciter focus has been readjusted, adjusting the lens—if its construction allows—is one possible remedy. Defective tubes in the photo-cell amplifier may be responsible. If the condition is confined to one projector, as is most often the case, a very short search among these three most frequent causes should clear up the trouble.

The above list by no means exhausts the list of troubles that can occur in a sound installation, and the methods described do not in any way exhaust the possibilities of dealing with them. Trouble and ways of finding it are almost inexhaustible subjects. The actual practices described in this and the preceding article are less valuable than the principles that lie behind them. *The principles, rather than the detailed practices, should be remembered and applied to individual conditions as found, according to individual preferences and habits of work.*

Before taking leave of this matter of trouble-shooting and going on to discuss other phases of sound service work, it may be well to re-list those principles briefly. They are:

1. Trouble-Shooting in Advance

(a) Acquiring adequate theoretical knowledge of the functioning of sound apparatus.

(b) Acquiring adequate detailed knowledge of the wiring, etc., of a given projection room.

(c) Advance preparation of meter-inspection, headphone tests and other trouble-shooting routines.

2. Systematic Trouble Hunting

Orderly procedure according to the routine prepared in advance for the more common types of trouble. In case of trouble of an unusual kind calm and common-sense efforts based on the idea of trying those things first that are most likely to yield results; avoiding waste of time by leaving hunches and desperate chances for the last resort.

3. Emergency Methods

It has already been hinted that some troubles can be cured or reduced by emergency methods (lowering volume, substituting amplifiers, etc.) before the real nature of the difficulty has been uncovered. A more detailed discussion of possibilities of this type will be found in the article to follow.

(To be continued)

HISTORY OF NITRO-CELLULOSE AS A PICTURE FILM BASE

Earl Theisen

HONORARY CURATOR, MOTION PICTURE COLLECTIONS, LOS ANGELES MUSEUM

THE following chronology deals with the evolution of motion pictures as produced photographically on a nitro-cellulose support carrying a light-sensitive emulsion of one kind or another.

1845-6.—The discovery of the cellulose nitrates about this time is credited to Schoenbein, who became associated with Böttger sometime subsequently to August, 1846.

1847.—The solubility of the cellulose nitrates, especially in alcohol and ether, was accurately investigated by Gladstone; these experiments no doubt led to the subsequent discovery of collodion.

1848.—Iodized collodion was used by Frederick Arthur Scott in his *calotype* wet-plate process.

1855. — Alexander Parkes was granted an English patent on parkesine, a substance similar to collodion, made by mixing anhydrous wood alcohol with guncotton.

1868.—Daniel Spill invented *xylonite,* a combination of pyroxylind, alcohol and ether; he was associated with Parkes in some of his work.

Invention of Celluloid

1869.—John W. Hyatt, of Newark, N. J., invented celluloid by combining collodion with camphor, for which he was granted a U. S. patent on June 15, 1869; in the patent specifications the name *pyroxyline* was used. Numerous patents were granted to the Hyatt brothers covering various uses of this material as artificial ivory. The name *celluloid* first appeared in the U. S. Patent Gazette on July 2, 1872, in the name of the Celluloid Manufacturing Co., of Albany, N. Y., assignee of the various Hyatt patents.

1876.—On November 9 of this year, an English patent was issued to Wordsworth Donisthorpe on the *Kinesograph,* a device to be used for taking photographs on glass plates arranged as a pack, each plate dropping out of the way of the succeeding plate after being exposed. Pictures were taken at the rate of eight a second. The patent specified that the pictures were to be finished on paper and spaced equidistantly thereon.

Another patent was granted to Donisthorpe on August 15, 1889, specifying the use of an electric spark for providing intermittent illumination in a viewing device. In *La Nature* appears the following description of Donisthorpe's work: "If the apparatus be arranged to take the successive pictures at sufficiently short intervals of time they may be printed at equal distances upon a continuous

strip of paper; this paper, with the whole series of pictures upon it, may be used in the instrument known as the *Zoötrope* or *Phenakistoscope* . . . Company a patent application on the this strip may be wound on a cylinder, to be unwound from it at a uniform speed to another cylinder, and so carried on past the eye of the observer, any ordinary means being used for insuring that the picture shall be exposed only momentarily to the observer. By this means the movements made by a person or group of persons, or any other object during the time they were being photographed, may be reproduced to the eye of the observer."

1884.—W. H. Walker and George Eastman, on June 27, 1884, assigned to the Eastman Dry Plate & Film process of coating paper with an emulsion having a soluble undercoating so that it might be applied to a stripping process; granted in 1890.

The Goodwin Patent

1887.—Hannibal Goodwin, in May of this year, applied for a U. S. patent on a method of preparing a celluloid support for photographic emulsions, the title being "Photographic Pellicle and Method for Producing Same." The patent was granted on September 13, 1898; it is said that Goodwin did not reduce it to practice. This patent was later the subject of lengthy litigation, which was ultimately decided in favor of Goodwin's successors.

1888.—John Carbutt, in Philadelphia, began the commercial manufacture of films coated on sheet celluloid, obtained from a company in Newark, N. J. He apparently experimented with this product for two or three years before he could make it commercially.

1888.—Wallace Gould Levinson on June 26 applied for a U. S. patent, which was subsequently granted, describing further developments along these lines.

1889.—On April 9, Harry M. Reichenbach applied for a U. S. patent, which was granted on December 10, on a method of making transparent sheets of celluloid; a mixture of methyl alcohol, camphor, nitrocellulose, amyl acetate, and fusel oil was dried on a polished support, after which it was stripped off and coated with the photographic emulsion. This patent was assigned to the Eastman Dry Plate Company. The apparatus for coating the film base was patented by Eastman on March 22, 1892. According to present records, the first supply of this stock to be used for producing successful motion pictures was sent to W. K. L. Dickson at the Edison Laboratories in July or August, 1889.

1891. — Eastman daylight-loading roll was introduced.

1895.—In August, Eastman introduced the first positive motion picture stock; prior to this time motion pictures were made on negative film, which could be bought in 100-foot lengths. Many experimenters in Europe at this time bought the Eastman uncoated nitrocellulose film bare and coated it themselves, notably the Lumière brothers in France.

1903. — Eastman introduced film having a gelatin coating on the rear surface in order to counteract curling of the film; the process had been patented by him in 1890.

1904.—W. C. Parkin, in France, was granted a patent on a method of making celluloid non-inflammable by adding a soluble metallic salt to ordinary celluloid. Subsequently, many others, chiefly in France, were granted patents on various ways of rendering celluloid non-inflammable or slow-burning, by means of adding various metallic salts.

Panchromatic Negative

1913.—In September, Eastman introduced panchromatic negative motion picture film.

1919.—Eastman introduced for the first time film that had latent image footage numbers printed on its edge; the markings included also the date, which was later omitted, and the markings evolved into the form as used today. The system was patented by Joseph Aller in 1922, the application being made in 1917.

1921.—On March 1, Eastman introduced colored base positive raw stock in nine colors: orange, amber, light amber, yellow, pink, red, green, blue, lavender, in addition to clear (black and white). Prior to this time, colored stock had been made in the various finishing laboratories by dyeing the emulsion after the processing of the picture.

1923.—In January, Eastman introduced the 16-mm. reversal film and apparatus for amateur use.

[NOTE: Under the heading "1889" the statement is made that Reichenbach applied for a patent which was granted and which was assigned to the Eastman Dry Plate Company. The sound of that is that Reichenbach made the discovery and Eastman bought his patent. Investigation uncovers the fact that Eastman hired Reichenbach to undertake the job of finding how to make a satisfactory transparent, flexible film, and Reichenbach made the discovery and got the patent while he was in the Eastman employ.

Another obvious comment is the termination of the history at the year 1923, since which date much development work has been done. There come to mind the developments of the Sonochrome series, with seventeen tints (1929); Super-sensitive Panchromatic (1931); and grey-backed film (1931). Also, no mention is made of the introduction of the so-called "safety film" in 1909.—EDITOR.]

LOCAL 306 COURT CASES

The case of 279 permit men vs. Harry Sherman as president of Local 306, William Green as president of the A. F. of L., and William C. Elliott as president of the International Alliance, which will determine the legal status of permit men as members of organized labor, will go to trial in New York City on June 6. All I. A. units will watch these proceedings with considerable interest, as the case is expected to reflect accurately the status of permit men throughout the country. No official statement of position has been forthcoming from the defense.

Before the June term of the Appellate Division in New York City will be argued the appeal of Sam Kaplan from the decision which validated his removal by the I. A. as president of Local 306. During the same month will be heard the appeal of Kaplan and other defendants from the decision of a jury which found them guilty of coercion in matters affecting the Local 306 membership. Of the nine defendants found guilty, only Kaplan and Greenberg were given jail sentences, execution of which was suspended pending appeal.

The Kaplan case is expected ultimately to be reviewed by a general convention of the I. A.

W. E. PRECISION TIMER

Official approval of the Federation Aeronautics International, the governing body of aeronautic speed contests throughout the world, has been given to the Western Electric Precision Timer and the timing system under which it operates. The superior facilities of this equipment for accurate timing in one one-hundredths of a second were so clearly established that the National Aviation Association of America urged its international acceptance.

Remember that new lenses must be used if the size of the screen is increased. Consult a lens chart for the right size of lens to use.

THE PROFESSIONAL PROJECTIONIST

Dr. A. N. Goldsmith

PRESIDENT, SOCIETY OF MOTION PICTURE ENGINEERS

DR. A. N. GOLDSMITH

—only a partial biography of whom would include such activities as president, S. M. P. E.; past-president, Institute of Radio Engineers and present editor of this body's "Proceedings"; former vice-president, Radio Corp. of America; professor-emeritus of electrical engineering, C. C. N. Y., and technical consultant for Radio City, New York.

Dr. Goldsmith regards projection as the "neck of the bottle" through which flow all other industry activities. He holds that general respect for and confidence in the projectionist will come only after the latter exhibits respect for his profession and aims at consistently high quality work.

As president of the S. M. P. E., Dr. Goldsmith has proved to be a real friend of the projectionist, one of his "pet" interests being the work of the Projection Practice Committee, all sessions of which he has attended during a period of more than a year.

ONE definition of a "craft" is "an occupation or employment". A "profession" has been defined as "any calling or occupation involving special mental and other attainments or special discipline". There are reasons worthy of consideration for regarding the delivery of pictures and sound to the theatre audience as of such nature as to justify designating projection as a profession.

The final step in the processes of picture (and sound) production and exhibition is the projectionist's work in the theatre. If the theatre equipment is permitted to remain in poor condition or if it is inexpertly handled, audience satisfaction is jeopardized. The labor, materials, and expense which have accompanied the making of the picture in the studio (including, of course, the work of the author of the story and of those who have adapted it to cinematic needs), the cost of making and delivering prints, and the expense of operating the theatre and advertising the production in question may, in an extreme case of apparatus inadequacy or unskilled projection, be lost so far as the audience is concerned.

Audience Satisfaction Paramount

Since the audience is the direct source of whatever financial support the motion picture industry enjoys, and since the continuance of the activity of every branch of the industry thus depends on audience satisfaction, it is obviously poor policy to economize unwisely in the fields of projection personnel and their equipment.

It is likely that it is particularly hazardous at this time to risk displeasing the audience. Audiences today are made up of many persons who may be nervous, harassed, and insistent on being presented with so perfect and compelling an illusion that they are, in effect, transported to another world where their daily problems may be forgotten. It is for this psychological release that they make a bargain at the box office—and they are impatient if the bargain is not kept. It is not intended to minimize in any way the fundamental importance of all the other processes and activities involved in the motion picture field, but it must be insisted that the profession of projection takes its place with those other, and more generally mentioned and understood, professions which are involved in the world of pictures.

There is one aspect of the work of the projectionist which has not been emphasized so strongly as it might be, and that is the recurrent need that the projectionist shall meet small and great emergencies promptly and effectively. If the projectionist were serving a few people at a time, his promptitude and effectiveness would be relatively unimportant. But, considering that hundreds or thousands of persons have their attention concentrated on his work, any prolonged interruption or avoidable imperfection is shown up glaringly and creates a profound and unfavorable impression.

The meeting of an emergency may be a comparatively simple task in some instances, as for example in maintaining sharp focus of the picture. Yet it is an urgent task even in these cases. If, however, film breakage, equipment failure, or above all a film fire, should occur, the projectionist immediately becomes by far the most important person in the theatre. He can make or mar a reputation in a very few minutes; and in extreme cases he can prevent an appalling disaster or panic by cool and skilled work.

An Analagous Profession

It is instructive to examine similar professions in the motion picture and radio industries. In the latter field, the control room operator has a function in relation to sound transmission which is in general similar to the work of the projectionist in the control of the sound level in the auditorium. It is true that the level of the sound recorded on a properly made film is such that less level adjusting is required in the projection room than in the broadcast control room, and this is fortunate considering the numerous additional duties of the projectionist. The men handling the operation of a broadcasting transmitter encounter some problems similar to those of the projectionist. They also deal with sources of power, amplifiers, and output circuits, although the detailed nature of the circuits and equipment and the magnitude of the powers involved are widely different in the two cases. It is significant, however, that the resourcefulness of the radio men in the face of an emergency which threatens a prolonged interruption of service is as necessary as in the case of the projectionist, yet the projectionist has the additional element of danger involved in the possibility of a film fire. Physical danger as well as mental distress

may occasionally be encountered by the projectionist.

In the motion picture industry, the cameraman and the sound recordist have duties of a nature roughly similar to those of the projectionist, except that each of them is required to concentrate only on *either* the picture *or* the sound, whereas the projectionist must concentrate on *both*. Focussing, centering the picture, maintaining or judging illumination, handling sound level controls, and maintaining electrical equipment in steady operation (with great financial and prestige loss in case of an interruption), are elements found in the work of both the studio men and the projectionist. It is worthy of mention that the camera man and the sound recordist are granted recognition and at least some brief fame through their honorable mention on the leader strip of the film.

The projectionist, on the other hand, enjoys anonymity. If the recital of the names of stage managers, painters of scenery and purveyors of shoes, on a theatre program is a justifiable procedure (and it probably is), it might be well to let the audience in a motion picture theatre know the names of the skilled projectionists who are steadily working for them "behind the scenes."

Many Diverse Duties

The nature of the routine work of the projectionist is readily enough defined. It consists in the maintenance of a bright, sharply focussed, centered picture free from travel ghost, and the provision of clear sound of correct level and controlled tone quality. In addition, the care of the film while in the theatre devolves on the projectionist, together with such incidental operations as rewinding, patching or splicing, and the like. The equipment for picture projection and sound reproduction must be well understood so that any repairs except those requiring unavailable parts or special testing tools, may be rapidly made by him. He must cooperate with the engineer, the apparatus manufacturer, and the service man. In addition, a gift of oratorical persuasiveness is useful to the projectionist who is discussing the purchase of testing equipment, spare parts, or replacements for worn parts, with some of the less generously inclined exhibitors. In justice to the more far-sighted exhibitor, it should be stated that in his case this persuasiveness is not required.

As will be gathered from the foregoing, the work of the projectionist enters the fields of mechanical operation and of optical, acoustical, and electrical principles and practices. To function intelligently he requires a good working knowledge of those portions of each of these fields which are applied in the equipment of the projection room and in the loud speakers on the stage—and this is equivalent to saying that he requires a fair appreciation of a considerable portion of the less complicated parts of these fields and also some knowledge of some more complicated matters. In any case, even an avid learner will not become a knowing projectionist overnight, quite apart from the acquisition of the manual skill and deftness which is required in this profession.

What of the Future?

It is likely that the field of the projectionist will expand rather than contract as time goes on, and that the knowledge and experience he will require will increase as innovations in the field are introduced into the theatre. Color motion pictures will bring some problems of illumination, screen color and arc color in their wake. Three-dimensional pictures (if and when they arrive), will probably further tax his ability. Special sound effects along some lines not yet introduced in the industry will add to the complication of the projectionist's task. And it is at least conceivable that television reception and the projection of television pictures on the regular theatre screen will add to the projectionist's training, his technical library, and his required skill.

It is clearly evident from this analysis that the forward-looking projectionist should be exceptionally interested in the work of the Society of Motion Picture Engineers and of the three important committees of the Society which are continually studying and reporting on his problems, namely, the Projection Practice Committee, the Projection Theory Committee, and the Projection Screens Committee. The projectionist and engineer should be closer to each other in the future. Many an engineer can get useful information and practical guidance in apparatus design and construction matters from the thoughtful projectionist. The service man can save time and get better results if the projectionist is interested in the equipment, communicates a clear statement of any symptoms of trouble, and suggests the probable cause of the difficulty.

It is therefore to be hoped that the projectionist, the service man and the engineer will continue to work together more closely and that they will all play their part in the activities of the S M. P. E. which exists solely to help them and their fellows in the industry to attain ever more consistently satisfactory achievements.

Motor Generators vs. Mercury Arc Rectifiers for Projection

The accompanying discussion of the relative merits of motor generators and mercury arc rectifiers for projection work appears herein through the courtesy of Mr. Stanley T. Perry, president of the Guild of British Kinema Projectionists and Technicians. In forwarding the ms. Mr. Perry states: "Here is a rather interesting commentary which appeared in a recent issue of our own "Journal" and which I think will prove of great interest to your readers as a supplement to the fine material along similar lines which you have published." Thanks, Mr. Perry.—EDITOR.

I AM neither die-hard nor brain-soft on this question and fully appreciative the good features of Motor Generators under certain conditions, but I am one of those people who have come to the conclusion, after experience and investigation, that given an AC supply, the Mercury Arc Rectifier is generally the best means of supplying the arcs.

It is claimed that the Mercury Arc is more efficient than the Motor Generator. The figures on which this claim is based are openly published by the rectifier manufacturers in various articles and in their catalogues. In the first paragraph your contributor refers to these as super-performance figures (he almost hints unbelief); by the third paragraph they are considered quite low. I have examined the motor generator performance figures given, and these when compared with the explanatory remarks show two things:

1. The motor generator manufacturers are to be congratulated on the progress made and are obviously not to blame for the wrong construction put on their figures by your contributor.

2. Either deliberately or in ignorance your contributor does not appreciate the fallacy of comparing *special* figures with *average* figures—anyhow he proceeds to do this in order to make a case for the motor generator.

For it should be noted that your contributor goes on to say that the standard efficiency of a motor generator set when running on three-phase at half load is in the neighborhood of 70-75 per cent. Why, therefore, give a set of figures, presumably meant to be representative, varying from 75-80

per cent? In the same way he goes on to say that in the case of single-phase the motor generator efficiency is not so high—yet as an example he cites a figure of 75 per cent.—that is, equal to the upper limit he has just stated for a three-phase set.

It should also be known that the standard efficiency of a mercury arc at half load lies between 77 and 80 per cent, which is considerably higher than the average motor generator performance figure. The losses of a rectifier installation can be decreased by a further 20 per cent if stabilizing choke coils are employed to reduce the resistance losses, thus giving still a very much increased overall efficiency (about 15 per cent) over that possible with the most efficient motor generator set.

My impression is that to find which converter gives better light results for projection, the best method is to measure it. I have witnessed such tests and they showed the rectifier to advantage. To talk of the smoothing chokes being a possible source of trouble is just silly. One might as well say that the connecting leads from the equipment to the load are also another possible source of trouble (undoubtedly true but silly). Again, one of the many advantages of the Mercury Arc is the negligible voltage drop experienced under working conditions, and if your contributor took the trouble to read the announcements which he sets out to criticize, he would know that a rectifier can be equipped with any range of voltage control desired.

Operating Noise Levels

With regard to noise, most manufacturers of motor generator sets may give certain guarantees regarding noise on their machines and it may be possible, by suitable mounting, to eliminate objectionable noise entering the building from the motor generator set. And what may be offered in all good faith as a noiseless machine may not prove sufficiently silent when installed. After all, motor generators are rotating machines and there must always be a certain amount of noise associated with such an equipment. A rectifier might prove noisy due to magnetic hum; but then there is something wrong and can be corrected and altered, therefore, it is easiest to solve this problem of noise by employing a static rectifier.

The question of space is, of course, a point for the rectifier, as where there is very limited space the rectifier is probably the only solution. I agree with your contributor that to put a rectifier or motor generator in some out of the way corner, where nobody can get at it easily, is bad engineering practice—if there be plenty of room available. But after all, we live in an imperfect world where we can't have had all the room we want and it is certainly to the advantage of the rectifier that it can be placed anywhere and give no trouble.

The extra cost involved in the upkeep of a motor generator such as replacing brushes, oil on the bearings, grinding of commutators, etc., is certainly another point in favor of the rectifier, even if the motor generator results are so good as those obtained in the theatre in which your contributor is interested.

In conclusion, let me say that I am not at all averse to motor generators and am not unmindful of the very good work they have done and are doing; but if people want to be helpful in contributing to a discussion on their merits, let us have at least consistency, and if possible, accuracy. The motor generator for all larger work was long ago superseded by the rotary converter and motor converter, which in turn have been superseded by the rectifier for the most strenuous and important public supply duties—on light and power distribution networks, on tramways and railway systems. To say, therefore, that the rectifier still is on trial is, to say the least, absurd.

PRODUCTION PROCESS FOR ANIMATED CARTOONS

William Garity

WALT DISNEY STUDIOS, HOLLYWOOD, CALIFORNIA

Always important to the well-balanced motion picture program, the animated cartoon benefited tremendously through a clever utilization of sound accompaniments and, lately, through color. Probably the outstanding motion picture cartoons are the *Mickey Mouse* and *Silly Symphony* subjects produced by Walt Disney Studios, and the accompanying paper by Mr. Garity, originally presented to the Pacific Coast Section of the S. M. P. E., explains in detail the production process at these studios.—*Editor.*

II

WHEN the animator has completed his particular scene, the drawings are turned over to the Inking and Painting Department, the function of which is to transfer or trace each drawing on celluloid sheets. These celluloid sheets are the approximate size of the paper, and about 5/1000ths of an inch in thickness. They are perforated with registering holes, identical to those in the drawing paper. The paper drawings are placed on the registering pins, the celluloid sheet is superimposed on the drawing, and a very careful tracing of the drawing is made with black India ink. After the tracing of the outline has dried, the celluloid is reversed, and the entire area occupied by the figures on the drawing is made opaque with paint.

The primary reason for using celluloids is an economic one. If the transparency were not used, it would be necessary to draw a complete background for each frame of the picture, which, of course, would be an economic impossibility. To avoid doing this, a single background is drawn, the characters working against this background being traced on the celluloid sheets. As the entire area occupied by the character is rendered opaque, the background is completely matted out by the character when the celluloid sheets, inked and painted, are superimposed on the background. It is possible to have a large number of characters, each doing something different, by tracing each character on a separate sheet of celluloid, and simultaneously superimposing these celluloid sheets upon the background. The use of many such celluloid sheets aggravates the photographic problems, due to the light losses and color changes introduced by the celluloid. Four sheets seem to be the greatest number that may be used without seriously affecting the photography.

For rendering the celluloid sheets opaque, white, black, and five shades of gray paint are used. When a number of characters are superimposed simultaneously on the background, 1, 2, 3, or 4 sheets of celluloid are used. In order to produce the same color value in the negative, five different shades of gray paint must be employed. The darkest shade is used on the top sheet and the lightest on the background. This is necessary because of transmission losses inherent to the celluloid. The thickness of the sheet is also a factor to be considered; and for that reason all sheets are carefully graded as to thickness and color, in order to minimize the painting problems and reduce density changes in the half-tones of the film.

After the picture is photographed, all traces of the ink lines and of the paint are removed by washing, thus reclaiming the sheets for later use. In practice, the celluloid sheets are never

(*Continued on page 29*)

REPRODUCING ORCHESTRAL MUSIC IN AUDITORY PERSPECTIVE

The Result of Researches at Bell Telephone Laboratories

THREE classes of requirements must be met if reproduced sound is to be indistinguishable from the original. Two of them, that both the complete frequency and complete volume ranges be transmitted, have been generally recognized for some time. The third, that the sounds must be reproduced with the correct auditory perspective, has been fully appreciated only by those most closely associated with the science of sound reproduction.

Sounds in general are composed of a group of tones and over-tones ranging from the deep bass of the lowest organ notes, or those of a bass drum, to the shrillest tones the ear can hear. Each note of a musical instrument has a fundamental tone and a group of harmonics. The fundamental tone sets the pitch, and the harmonics give the note its quality. It is the harmonics that make it possible to distinguish a note on a violin from one on a trumpet or from any other of the same pitch. It is in the harmonics that reside the richness of music and the wealth of sensuous appeal.

Frequency Data

These tones and over-tones are known and recognized by their frequency, or vibratory rate; and the range of frequencies to which the ear responds runs from about 16 cycles per second to 16,000, or even 20,000 cycles for some ears. The sensitivity of the ear falls off rapidly at the higher frequencies, however, so that the effect of frequencies above 15,000 cycles is negligible for the most part. The highest note on the piano has a fundamental frequency of only about 4,000 cycles, and few of the musical instruments exceed this pitch, but the accompanying harmonics or over-tones, which are of still higher frequencies, are very necessary to the proper quality and richness of the notes.

Of no less importance, if the full aesthetic effect of music is to be obtained, is the range in volume. The ear has a recognizable range of volume as it has of frequency. This extends from sounds so low that the ear cannot hear them, to sounds so great that the sensation is one of pain rather than of hearing.

For convenience in scientific study, the power of sounds is graded in units known as decibels (abbreviated "db"). The threshold of hearing is taken as a reference base, and the ordinary audible range runs from the volume of sound one would hear in a quiet garden, or that of an average whisper at a distance of four feet, which are at a level of 20 db, to that of a pneumatic riveter, at a level of 100 db—a total range of about 80 db. The range of a large symphony orchestra is about 70 db, so if the music of such an orchestra is to be faithfully transmitted electrically, a volume range of the order of 70 db must be transmitted: a range of power of ten million to one.

The third requirement becomes of particular importance when the sound to be transmitted and reproduced is that from a large and relatively widely spaced group of instruments, such as a complete symphony orchestra. When one sits in an auditorium and listens to a symphony concert he experiences something that is over and above the effect produced by the actual frequency and volume range given out by the orchestra.

Output of high frequency horns divided into 16 diverging rectangular sections, spreading the sound over an arc of 60 degrees both vertically and horizontally—the total horizontal spread of two such units being 120 degrees

"Auditory Perspective"

This additional appeal is difficult to describe, and almost impossible to measure. It is partly due to a spreading of the sound in all directions so that it fills the entire volume of the auditorium and thus reaches one's ears by various paths. It is partly due to other factors; but whatever its cause, it results in a richness and texture of tone that no ordinary electrical reproduction can provide. For lack of a better term, the effect may be called *auditory perspective.* Without it the music would be one-dimensional and not expanded into its true spatial relationship. The difference may be compared to that between the appearance of a photograph of a scene and the same scene when viewed through a stereoscope.

How to obtain this auditory perspective in music transmitted and reproduced electrically was discovered by scientists of Bell Telephone Laboratories. It was found that by employing two microphones, one properly located on each side of the stage, and by transmitting over two separate circuits to two of the newly developed loud speakers, similarly placed, the effect of the actual presence of the orchestra was successfully obtained.

Even with the discovery of a comparatively simple means of obtaining true auditory perspective, the problem was not completely solved. Never before had either the complete frequency, or the complete volume range, of a symphony orchestra been commercially transmitted and reproduced. No complete chain of apparatus, from microphone to loud speaker, was available that would faithfully transmit the entire range of frequency and volume. Microphones perhaps offered the fewest difficulties. Bell Laboratories had already designed sensitive microphones that would transmit practically the entire range required, and only

minor modifications were needed to make them entirely suitable.

New Amplifier Development

This was not true of the amplifiers. There had to be developed amplifiers which would faithfully transmit all frequencies from 35 to 16,000 cycles at levels from the barely audible pianissimo effects to the resounding orchestral crashes of ten million times greater power; and all the pieces of apparatus had to be so designed that even during intervals of complete silence not the slightest noise would be introduced to suggest the presence of electrical apparatus. No underlying hum or noise, such as is commonly present in radio or other systems of reproduction, could be tolerated with the new apparatus. In the intervals of silence there must be real silence; a dead auditory void in which the fall of the lightest pin could be heard. This has actually been accomplished to a degree heretofore unknown.

Probably the most quiet electrical reproduction up to the present is that obtained with high-grade sound picture apparatus; but such apparatus at its most quiet moments gives off 300 times more sound than the new apparatus when the musicians are silent.

Of even greater difficulty possibly was the design of suitable loud speakers. It is not practicable to obtain the entire frequency range with a single unit, and so two types of loud speakers are used. One, somewhat resembling the horns used for sound pictures, is employed for the frequencies from 35 to 300 cycles; and another type, for the range from 300 to 16,000 cycles. These loud speakers are different from anything previously produced commercially. Never before have these elements fulfilled such difficult requirements of frequency range and volume.

The best sound picture system record and reproduce approximately half the range of frequencies handled by the new loud speakers, and the best radio systems even less. In volume range the comparison is equally remarkable. Although sound picture systems under the most favorable conditions may provide a volume range of 40 to 45 db, radio systems rarely exceed 30, while the range provided by the new apparatus is well above 80. Whereas the power range of radio is of the order of 1,000 to 1, the new equipment is capable of yielding a range of 100,000,000 to 1.

Improved Sound Distribution

The new loud speakers and their associated equipment of amplifiers and microphones are, therefore, fully capable of handling the entire volume range of a symphony orchestra. When one speaks of range of loudness which can be handled by an electrical system for reproduction, one is concerned with the differences between the loudest and faintest passages of the music which it can reproduce. There is in addition the problem of handling the peaks of maximum loudness. These peaks in the case of music from a symphony orchestra are beyond the possibilities of the ordinary loud speaker to reproduce without distortions which seriously affect the musical sonority. The low frequency sounds make the largest contribution to the peaks of sound power which must be handled to meet these conditions. The diaphragm of the low frequency element in the new loud speaker has been made nearly seven times larger than that of the elements used ordinarily for sound picture reproduction. By these diaphragms a large column of air is set into motion.

The ordinary loud speaker also becomes directional in its characteristics at the higher frequencies. Low frequency sounds spread in all directions from the mouth of the horn, but the higher frequencies tend to concentrate into a beam projected directly ahead of the horn; and the width of the beam becomes narrower and narrower as the frequency increases. Because of this fact, the audience, in a large hall equipped with the ordinary loud speakers, never hear quite the proper blending of frequencies. Those directly in front of the horn receive too great a proportion of the higher frequencies, while those on the sides receive too much of the low frequencies. To avoid this effect, the horn of each high-frequency element is divided into 16 diverging rectangular sections which spread the sound over an arc of 60 degrees vertically and one of 60 degrees horizontally. Two of these units placed side by side thus spread the sound over a horizontal angle of 120 degrees—a far wider coverage than has been obtained before and one which distributes the sound throughout the auditorium with a faithful blending of the frequencies.

Besides providing for the full volume range of the orchestra, the amplifiers have an additional amplification of at least 10 db, so that, if desired, the volume of loud passages may be made ten times as great as the actual output of the orchestra. Technically described, the maximum sound power of a symphony orchestra integrated over an interval of two-tenths of a second is less than 20 watts, whereas that possible from the loud speakers of the new apparatus is more than 200 watts. This additional gain allows effects to be obtained which have been impossible before. Besides the effects of range and quality of tone, the total aesthetic appeal of an orchestra is due in no small degree to the range in volume. The number of musicians one can place on a stage is limited. To put ten times as many as contained in a modern symphony orchestra is impossible in any existing hall. The control of volume given by the new apparatus enables the director to secure at will the equivalent of an orchestra of nearly a thousand musicians.

The advantage of this control of volume does not end here, however. Its presence makes it possible to reproduce operatic music, where a soloist is accompanied by an orchestra, without allowing the voice of the singer to be drowned out by the louder passages. For this purpose a third channel, including its separate microphone, transmission line, and loud speaker, has been provided in the new system

(Continued on next page)

Some question may arise in the minds of our readers as to the quality superiority of Auditory Perspective transmission over that customarily experienced from the operation of standard sound motion picture equipment, such as is used in theatres. In this connection, aside from the fact that the former embraces especially developed amplifiers and loudspeakers together with associated apparatus, having an effective overall response characteristic of about 30 to 16,000 cycles, there will be remembered the comparison involves direct pick-up and transmission to the auditors of the sound on the one hand, while on the other we have an indirect or delayed transmission wherein the sound after being picked up is stored in a record (film or disc), later to be taken off and transmitted. More losses are naturally introduced under the latter conditions, the sound passing as it does through several energy transformations.

Further, it will, of course, be appreciated that the Washington Auditory Perspective demonstration represents the consummation of a certain amount of research work and was presented as an experiment, and therefore was not subject to economic or physical limitations such as surround the commercial exploitation of sound equipment for any given purpose.—*Editor.*

S. M. P. E. PROJECTION SCREENS COMMITTEE REPORT*

SINCE its last report, the Committee has engaged in studies on several matters pertaining to screens and projection practices. The most important of the subjects considered are: standardization of sizes of manufactured screens, a simple method for determining reflectivity of the screen in the theatre, and sound transmission characteristics of screens in connection with the extension of the range of frequency of reproduced sound. These, with other matters of interest, are discussed in the following sections.

The Committee has been considering the possibility of standardizing screen sizes ever since it was organized. There are several reasons for standardization. According to manufacturers, the foremost advantage will be the elimination of errors arising in ordering and assembling screens. There is also the possibility of economy due to the fact that the process of assembling screens according to standard specifications may be resolved into a standard procedure. Another advantage is the inherent convenience of standards, as contrasted with a haphazard, chaotic state.

With these thoughts in mind, the Committee has prepared a list of screen sizes that appears to fulfill the requirements of simplicity and generality of application. Table 1 shows the proposed standards.

It will be noted that the key number designating the screen is made to correspond to the *width of the picture* It is believed that the picture width, as a more fundamental quantity, represents a more appropriate selection for designating screen sizes than either the full screen width or the width of the frame. This also accords with the procedure for determining projection lenses. The full width of the screen, including the borders, will be about 5 inches greater, and the inside frame width an additional 8 or 10 inches, where the screen is laced to hook on the inside. In the event that a given screen has a picture width intermediate between two of the proposed standard sizes, the screen to be chosen shall be the larger size, if possible. In some cases, this might be desirable from the point of view of the audience, even though it might necessitate alteration of the supporting structure. It is felt that a one-foot separation between sizes is small enough for most practical purposes, besides being convenient.

Screen Proportions

The proportion of width to height has been chosen as 4 to 3. For a projection angle of 18 degrees, which represents an average condition, this ratio will require a minimum amount of masking on the basis of the new standard aperture. For other angles, more masking will be necessary. If, however, a 4⅛ to 3 screen ratio were standardized, it would be theoretically correct for horizontal projection only, and would require an increasing amount of masking and a correspondingly greater amount of unused screen surface. The 4 to 3 ratio has the further advantage that a large number of existing frames are made to accommodate screens of such shape. Another advantage is the simplicity of the ratio and the ease of computing heights from widths.

It was thought that after standardizing on sizes, manufacturers would be required to stock only a relatively small number of screens. The Committee is informed, however, that this would be impracticable inasmuch as deterioration would soon set in. For this reason, it has been customary to make screens to order.

The Committee also recommends that the standard spacing of grommets be 6 inches, with 12 inches as a possible sub-standard. Some frames are designed for a 12-inch spacing, but these will also accommodate the primary standard. The smaller spacing permits a more even distribution of tension, which is especially desirable at the top of the screen. When assembling a screen, the first grommets should be placed in the center of each side and the process then extended to the edges. The screen, when mounted, should not be stretched too tightly, but some slack should be allowed to exist to compensate for changes produced by atmospheric conditions.

Screen Image Distortion

The discussion incidental to the adoption of the new standard aperture has helped to focus attention on the problem of screen image distortion. Such distortion involves three elements: the projection angle, the observation angle, and the size of the screen. Indirectly involved is the distortion occasioned in photographing or viewing the original scene. Masking a projected picture will avoid key-

(*Continued on page* 24)

*Presented at the Spring, 1933, Meeting at New York, N. Y.

Table 1
Proposed Standard Screen Sizes

Number Size of Screen	Width, Picture Feet	Picture Height, Feet	Picture Height, Inches
8	8	6	0
9	9	6	9
10	10	7	6
11	11	8	3
12	12	9	0
13	13	9	9
14	14	10	6
15	15	11	3
16	16	12	0
17	17	12	9
18	18	13	6
19	19	14	3
20	20	15	0
21	21	15	9
22	22	16	6
23	23	17	3
24	24	18	0
25	25	18	9
26	26	19	6
27	27	20	3
28	28	21	0
29	29	21	9
30	30	22	6
31	31	23	3
32	32	24	0
33	33	24	9
34	34	25	6
35	35	26	3
36	36	27	0
37	37	27	9
38	38	28	6
39	39	29	3
40	40	30	0

AUDITORY PERSPECTIVE

(*Continued from preceding page*)

primarily for the singer. The volume of output of this channel is controllable independently of the other two. In this way the loudness of the voice may always be kept just above that of the orchestra and the desired musical effect be obtained. There thus reside in the new apparatus possibilities heretofore unattainable; and telephonic research has laid a foundation for what may be one of the greatest advances in musical aesthetics of the present scientific era.

"Three-Dimensional" Reproduction

The auditory perspective effect is not restricted to placing sounds in their correct positions across the stage, but is three-dimensional. This was shown by having several sources of sound moved around the stage in Philadelphia, not only back and forth but high up in the center of the stage as well. The movement of each sound was faithfully reproduced by the loud speakers in Washington even when the sounds were carried high above the level of the stage floor.

RELATION OF ELECTRON FLOW TO CURRENT FLOW

N. H. Randall

OREGON INSTITUTE OF TECHNOLOGY, RADIO SCHOOL

THE substance of each of the accompanying statements was taken from as many text and reference books on radio theory. To the technically trained they are understood and accepted from the viewpoint adopted by the author of the book, but to the person just starting out to master the principles of electricity and radio, and studying from the numerous references at hand, this apparent contradiction is often confusing. Of course, there is always an explanation added stating that the mix-up is due to the fact that the direction of current was assumed to be from positive to negative before the action of electrons was known.

But does this statement clear up the matter to the new student? Experience has shown that in the majority of cases it does not, and the question that almost invariably comes back is: If the electron flow is the same as the current flow, and electrons flow from negative to positive, how can the current flow from positive to negative?

The following explanation and analogy has proven in class work to almost always settle the question in the student's mind, and it is given here with the hope that it may help some reader who is having similar difficulty.

Do These Statements Confuse You?

"Electron flow and current flow are the same. Therefore, current flows from negative to positive."

"The direction of current and the direction of electrons are opposite."

"The movement of the electrons through the circuit is current flow. The direction of the electron flow is from negative to positive . . . The direction of current from a direct-current generator is from the positive brush through the external circuit to the negative brush . . . When the direction of the current is known, the direction of the resulting flux may be determined by the right-hand rule."

"Although we speak of the current as flowing from the positive to the negative of the circuit, the electrons (which really are the current), flow from negative to positive."

Direction of Current Flow

When the assumption that current flowed from positive to negative was first made, electricity was used primarily for such purposes as lighting, heating, ringing bells and running motors. The effects produced by electricity were what we were especially interested in, and since no means were at hand to definitely prove which way the electricity was flowing, it was assumed to be from positive to negative, and this flow was called an electric CURRENT. This direction was probably decided on because the prevailing theory at that time likened the electric current flowing in the wire to the flow of water through a pipe. And since water flows from a high level to a low level, and we generally assume positive to be high compared to negative, the assumption for the direction of the current was the most logical one to make.

When electrons were discovered, however, it was soon proved that they were the only things actually traveling in the conductor, and that they did not move from positive to negative but from negative to positive. But this discovery did not change the effects produced by the electricity as it flowed through the various circuits. Lights still burned as before, heaters still got hot, bells continued to ring and motors continued to rotate without any difference in their action whatever. Apparently, then, from a practical standpoint, the knowledge of electron flow made no difference. But it did help from a theoretical point of view because it enabled us to more accurately predict how certain circuits would act.

During the time that the fluid theory was in use many rules and formulas were evolved to fix, for example, the relative direction of magnetic flux and the direction of the current causing it; or the direction of rotation of a motor when the direction of the currents through the armature and field circuits is known. All of these rules were based on the assumption that current flowed from positive to negative, and by the time the electron flow was found these rules had become so thoroughly fixed in electrical science that it was not practical to change them.

How, then, shall we retain these rules and at the same time state that electron flow is opposite to the direction of current? By continuing to assume that current flows from positive to negative, of course. So far, so good. But now comes the statement that the electron flow and the current flow *are one and the same thing, but opposite in direction to each other.*

Action of Electrons

To help to visualize what is going on in the circuit let us consider this illustration. When it is said that a current flows along a wire from positive to negative, what is really happening is that the electrons are moving from atom to atom of the wire in a direction from negative to positive. They move in this direction because the electrons are themselves a negative charge, and therefore the positive charge toward which they move attracts them, while the negative charge from which they move repels them. Now, as they jump from atom to atom they leave a positive charge on the atoms they just left, while the positive charges on the atoms they just jumped to have been neutralized by their own negative charges. In other words, the position of the positive charge in the circuit moves from in front of the electron to behind it as the electron moves along, and the change of the position of the positive charge is caused by the motion of the electron. Now, a positive charge on an atom is caused, not by adding any-

thing to it, but by taking an electron away from it. Therefore, nothing has moved in the direction of the positive charge except a condition, which condition is caused by the movement of the electron in the opposite direction.

To further illustrate this point take the following analogy, which may appear rather silly but nevertheless usually gets the idea over. Suppose we have a row of rocks with a frog sitting on each. If the frog on rock number one jumps to the bank his rock becomes vacant. Frog number two then jumps to rock number one and as he does so the vacant condition moves from rock number one to rock number two. This is the opposite direction to that taken by the frog.

If number three frog now jumps to rock number two, the vacant condition moves in the opposite direction to rock number three. In the whole picture what has moved? Nothing, actually, except the frogs. But due to the motion of the frogs the vacant condition moved in the opposite direction. Yet the vacant condition is nothing but a lack of frog on a rock.

Now to tie this up with the electrons and the atoms. Let the frogs represent the electrons moving from negative to positive, and let the vacant condition of the rocks represent the positive charge on the atom moving from positive to negative, or opposite in direction to the electrons. But the positive charge is nothing but a lack of electrons on the atom.

Definitive Terms

Now, if we must have something to pin our imagination to in order to understand electron flow and current flow, think of the motion of the electrons as the *electron flow,* and the motion of the positive charge from atom to atom as the *current flow.* That is as a matter of definition, let "current flow" mean the motion of the positive charge around the circuit, and "electron flow" mean the motion of the electron around the circuit.

Current, flowing from positive to negative, is measured in amperes, which is just another way of saying that it is measured in coulombs-per-second. The coulomb is the unit of electrical quantity. It takes about 6,290,000,000,000,000,000 electrons to equal one coulomb, so if that many electrons passed a given point in the circuit in one second of time it would be equivalent to one coulomb-per-second passing that point, or as we usually say, the current is one ampere.

Since the more electrons there are passing the point per second the more amperes there are flowing, it can readily be seen that the so-called current flowing from positive to negative depends entirely on the flow of the electrons from negative to positive, both as regards the direction of flow and the value of the current in amperes.

NOTES *from the* SUPPLY FIELD

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"KODACOAT" PAINT INTRODUCED BY EASTMAN KODAK

A PAINT produced especially for photographic darkroom and laboratory purposes has been announced by the Eastman Kodak Company, identified with the name Kodacoat. Kodacoat Paint was compounded to possess qualities making it useful for a number of waterproofing and chemical-proofing purposes in the darkroom and in other photographic quarters. It is non-inflammable, non-fogging, non-reflecting, acid- and alkali-proof and waterproof; it resists all chemical solutions, including oxidizing and reducing agents; it contains no phenolic compounds, it will stick firmly to any dry material, it doesn't become brittle or flaky, it needs no thinning, it is quick-drying, and it is odorless.

The photographic uses of Kodacoat Paint are many. With it, tanks made of wood, stone, cement, sheet iron, copper, or tin can be made waterproof and chemical-proof. It can be used for repair purposes. Tabletops can be made resistant to acid or alkali. Walls can be finished to resist all photographic solutions. Sinks and gutters can be lined. Hypo recovery barrels or boxes can be preserved. Darkroom floors can be made chemical-proof and can be sealed. Cement floors can be waterproofed. Funnels can be made chemical-proof. Reflections can be killed. Leather, cloth, or fabrics can be made waterproof and chemical-proof.

Darkroom Application

In addition to these photographic uses of Kodacoat Paint, this material is suitable for sealing and refinishing studio or laboratory roofs, and as a base for tile or patent floors.

Side walls of darkrooms from the baseboard up to at least six feet are likely to be spattered with solutions and should be properly protected. Although Kodacoat Paint comes in either a flat black or a glossy black, a flat black paint is the most suitable protection for darkroom walls. Kodacoat Paint, the only paint ever compounded specifically for darkroom purposes, is intended to provide complete protection.

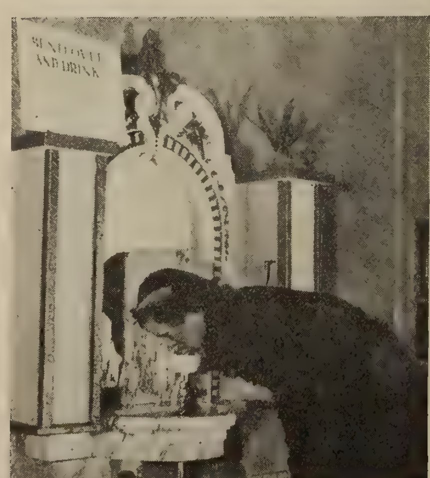
Above the six-foot line, protection against the ravages of photographic chemicals or water is unnecessary, but a safe color is still necessary. Another new paint supplied by the Eastman Kodak Company, "Panchromatic Green," has been compounded for this purpose.

Panchromatic Green is a light green which reflects all the light possible when a darkroom is lighted with a Panchromatic Safelight or a Series 3 Safelight. If, on the other hand, the room is lighted with a yellow or a red safe-light, the reflective power of the paint is still at a maximum for such a color. When a darkroom is painted with Panchromatic Green, the walls look light under the illumination of a Series 3 Safelight, and gray when the room is flooded with yellow light, but dark when red light is used.

ELECTRONIC DRINKING FOUNTAINS

PHOTO-ELECTRIC drinking fountains, the latest development of the electronic art, inject an air of mystery into the simple action of getting a drink. No handles are to be found at these fountains, but when patrons bend over to drink the water flows automatically until the person straightens up. In the illustration, a mirror can be discerned in the further pillar, just back of the girl. The mirror reflects the light beam onto the p.e. cell, thus controlling the operation of the fountain.

In such installations existing fountains are used, and standard photo-electric equipment may be obtained from G-M Laboratories, Inc., Chicago.



Typical theatre installation of G-M Labs. electronic drinking fountain

The EDITORIAL PAGE

Vol. 5, No. 3 MAY 1933

The Technician Comes Into His Own

Some months ago an enterprising radio publication sought to spur manufacturers of radio sets to improve the quality of sound reproduced by the receivers. The results of this symposium are very interesting. The bulk of the manufacturers replied that to improve the quality of sound would hurt, rather than help, their businesses: the public had become so accustomed to poor quality sound that a sudden improvement therein would be adjudged a defect rather than an advance in the art. We don't pretend to know the radio business better than those manufacturers who have had ten or more years of experience therein, but this viewpoint seems to us to have no basis in fact.

In sharp contrast to this estimate of public consciousness of what constitutes good sound reproduction are the results of symposiums conducted by various daily newspapers, with the general public being invited to contribute its views as to the relative merits of sound pictures vs. musicians and performers in person. In almost every case these answers included some such phrase as, "where the equipment is kept in order"—indicating the acute sensibilities of the theatre-going public to any mechanical defect which interfered with good reproduction.

Thus, it would seem that the radio manufacturers presumed too much in attempting to answer for the public, which seems to hold some very definite views of its own on this topic. It would seem, too, that any attempt to foist poor sound reproduction upon the public will be stoutly resisted, with such resistance taking the form of non-patronage of motion picture theatres. It seems that at last the general public has succeeded in selling to theatre-owners that idea which the technicians have never been able to sell, have never been able even to get a hearing upon, and that the fact that the theatre-owner must respect a good equipment and must meet the requisites for good operation of that equipment.

Sotto voce, we might express the hope that the technicians will continue to bear down on this point and make Mr. Exhibitor "like it".

Reflections on Wide Frequency Range Systems

A candid answer to those who have solicited our opinion as to the comparative merits of the new extended frequency range sound systems, now being marketed in the theatre field by at least two sound companies, would begin with the word "If"—probably in italics. In this single word, it seems to us, lies the success or failure of this new equipment. Recording and reproducing from 40 to 10,000 cycles is no sinecure, and even if the recording should be wholly satisfactory (printing being an especially tough nut to crack), there still remains the problem of insuring that reproduction in the theatre will be up to standard.

Every link in the reproduction chain will have to be near-perfect; the theatre itself will have to be acoustically satisfactory; the projectionist will be saddled with new and heavy responsibilities in the way of seeing to it that the equipment—not just part of it but every component—is in good condition; the exhibitor will have to expect to take the elastic off the bankroll for periodical purchases of parts—AND the film must be kept clean. This latter requisite simply must be satisfied.

Distributors of extended frequency range equipment must face the fact that all sorts of trouble may happen with this new and delicate apparati. It isn't going to be a matter of dumping a unit into a theatre and then let it be. Constant attention to every installation will be absolutely necessary—and this isn't meant to imply that only the sound company service men can handle the job. Any projectionist worthy of the name should be able to service a theatre sound equipment.

We have heard two types of extended frequency range equipment: one type is that which has been designed and manufactured as such, the other is that which results from "alterations" or "improvements" of existing equipments. Frankly, we do not believe in the latter process. Attachments to and alterations of existing equipment is an idea which has persisted in the motion picture equipment field almost since the birth of the industry. We think that this idea is nonsense. Some sound manufacturers, with full knowledge of the exhibitor's liking for an attachment to or alteration of existing equipment, will insist that an "alteration" will produce the same results as an all-new equipment. We don't believe it—and never will. If the idea of extended frequency range equipments be technically and economically sound, then it certainly merits an expenditure for all-new equipment. Puttering with old-style amplifiers and the installation of new speakers doesn't appeal to us as the sensible thing to do.

It may be said that the exhibition field cannot afford the cost of new equipments at this time. If this statement be true for a majority of theatres, then the sound equipment companies can do no better than to forget about extended frequency range for the present, particularly in view of the large stake held by these companies in the general welfare of the industry. It will do absolutely no good to make the little fellow's customers dissatisfied through supplying a limited number of theatres with extended frequency range equipments. This latter possibility appears quite remote at present, however, for our personal opinion is that extended frequency range systems still have a long road to travel before they deliver that quality of reproduction which is claimed for them. Some of these new equipments are the noisest, most disconcerting sound reproducers we have ever heard—yes, since 1928—and until these "bugs" are removed from the equipment we should prefer the old-style systems. Background noise is an outstanding defect in the new equipments, and there undoubtedly are others (horns, probably) that will have to be overcome before satisfying sound reproduction is assured.

"HIGH FIDELITY": ITS SIGNIFICANCE TO THE PROJECTIONIST

M. C. Batsel

PHOTOPHONE ENGINEER, RCA VICTOR CO., INC.

THE term "fidelity" has been chosen by engineers to apply to the characteristics of a reproducing system governing the amount of distortion present in the sound delivered. In the loud speakers for theatre applications, it is necessary to consider (a) power-handling capacity, (b) frequency range, (c) wave-form distortion, and (d) variations in sound over the frequency range for positions off the axis of the speaker.

Amplifiers must necessarily perform two functions in sound systems, first, amplify the feeble voltage produced by the photo-cells until the voltage is high enough to apply to the grids of the power tubes; secondly, the power tubes must be capable of controlling the necessary amount of power from the direct current output of the rectifier so that the current will be of the same wave-form as the voltage applied to the grids of the tubes. The fidelity of the amplifier is determined by the frequency range it covers uniformly without changing the wave-shape or producing harmonic distortion.

Improved Sound Head

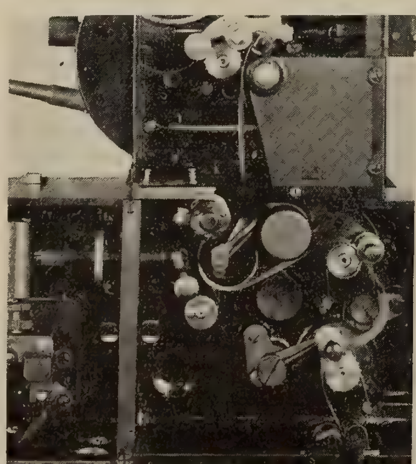
The sound head contains several elements which must be considered as of vital importance in connection with the overall fidelity of the system. The mechanism must be capable of moving the film past the scanning light with an absolutely uniform motion. Irregularities in the motion of the film result in variations of pitch if the change in speed of the film is relatively slow. If the irregularities occur at a rapid rate, extraneous frequencies are introduced. The scanning light beam must be thin enough to reproduce the highest frequencies to be required and uniform in brilliance across the sound track. Photocells must be capable of responding uniformly over the frequency range of the equipment.

RCA Victor Photophone High Fidelity equipment is the result of a great deal of study and experimental work to eliminate distortion and to increase the frequency range of each element of the system. The practical requirements from the projectionist's viewpoint have not been overlooked; factors influencing reliability, ease of handling, service and installation have been considered at all stages of the development. Most of the vital elements of the system have been in actual use in the all A. C. Photophone equipment for the last two years. The reliability and practical ruggedness of the designs have been thoroughly tested during this period, also many valuable suggestions in regard to refinements making for convenience in operation have been received from projectionists handling the equipment.

The improvement in fidelity has been made by refinements in the electrical design of the amplifier circuits, such as transformer coils, shielding, etc. The loud speaker improvements have been made by slight changes in the materials, coils, dimensions, etc. These changes, while sometimes not readily noticeable from a casual inspection, have resulted in a tremendous improvement in the performance.

Operating Conveniences

In the soundhead, the optical system is the result of several developments and changes made from time to time as the results of theatre installations indicated the desirability of improvement. The system can be focused in the theatre. The rotational adjustment is fixed and all optical systems are interchangeable. The barrel is oil-tight. This sound head has no fixed guides or shoes coming in contact with the film. There are therefore no gate surfaces to clean or tension shoes to adjust.



Showing path of film travel and constant speed drum in new RCA sound head

The condition of the film surface has no influence on the free passage of the film through the sound head. Threading is very convenient as there is ample space for the fingers. There are no inaccessible places for dirt and oil to collect. The motor is mounted directly on the sound head, the shaft extending through an oil-sealed bearing into the oil-filled gear case where a worm cut on the motor shaft drives the gearing to sprockets and projector head. A handwheel on the outer end of the motor shaft is convenient for turning the projector to check framing, etc.

The complete elimination of motor generator sets and batteries as sources of power supply should appeal to the projectionist, as there is no noise and no unsightly battery room or batteries to inspect and maintain. The rectifier equipment used for exciter lamp supply is of the copper-oxide type. This has been in use in A. C. operated equipment for more than two years with a most satisfactory record of performance. The tubes used are standard A. C. operated types. There is no audible hum at any operating gain, with the equipment having a frequency range from 40 to 10,000 cycles.

This Photophone equipment has been planned to minimize space requirements in the projection room. Mounting the motor on the front end of the sound head instead of on the side of the projector pedestal results in a maximum of unobstructed space between the machines. The amplifier racks are arranged so that they are entirely serviced from the front. This

NEWS and VIEWS

A collection of random thoughts and some not so random; fact, fancy and opinion pertaining to the projectionist and projection matters. The free-for-all forum.

Scramble on for Amplifying Equipment Work

THE following excerpt from the "Correspondence" department of the *Journal of Electrical Workers and Operators*, official organ of the I. B. E. W., should prove highly interesting to all I. A. men in the light of the I. A. rule which requires that all amplifying equipment must carry a card man:

"One cannot dwell too much on the point of all business managers and members of the I. B. E. W. going after the public address or amplifier game. There are more of these systems being put into use every day. Even carnivals and the circuses are beginning to use them. These systems should be, when a permanent job, installed by the regular electricians of your local union and then the operating turned over to the radio division. All temporary jobs are installed and operated by the radio men. There is quite a volume of this business throughout the country and if the members of the I. B. E. W. don't go after it and get it, some other organization will. It belongs to the I. B. E. W. and gives its members lots of work that it needs, so do you all see why the Radio Division of L. U. No. 1 is stressing this point so much?"

Coast Agreement Referred Back to Local Units

EFFORTS of the International Alliance and producer representatives to negotiate a new agreement covering the West Coast studios were deadlocked on the issue of recognition for film editors and cutters, which group previously have not been included in the basic studio agreement. Producers show no disposition to recognize this group of technicians, insisting that the number of crafts now included in the basic agreement should stand as is.

The basis of settlement was referred back to the various coast unions involved in the basic wage agreement, the vote to determine the official attitude of the I. A. in the matter. As matters now stand, it appears unlikely that the localized voting can be completed in time to effect any settlement before July 15.

P. A. McGuire Relinquishes Council Post

THE resignation of P. A. McGuire as executive vice-president of the Projection Advisory Council marks something more than the retirement of one who has fought long and well in the interests of a better craft and advanced projection standards. It really marks the end of an era—an era in which projectionists graduated from the status of a "union labor" man to the position of a craftsman, an era in which many good things fell to the lot of the man who knew his business and took the trouble to apply everyday horsesense in following those developments within his craft which led to better things.

Mac's contributions to this general advance by the projection craft are so well known as to need no recounting here. "Mac" he is to projectionists from coast to coast, in Canada and in many other foreign lands—and this fact in itself is indicative of the power for good exercised by P. A. McGuire.

The aims and accomplishments of the Council have been the topic of many articles—for and against—but the fact that the Council today is not the organization visualized by Mac when he founded it four years ago certainly is no fault of his. Mac invariably "played the wheel": he had several stews brewing at one time, and he was always sure of pulling at least one edible melange out of the fire. Economic conditions which have prevailed since 1929 have been discouraging to many organizations, and there always is staring one in the face the indisputable fact that projectionists themselves were very slow in taking advantage of a movement which bid fair to render them immeasurable good. The old standbys rallied 'round the Council standard, true, but the rank and file of projectionists were much too busy reading the ticker or oiling their new Superior 8.

But enough of this. Let it be recorded here that that degree of success which the Council may enjoy in the future will be but the reflection of the stupendous energy displayed by P. A. McGuire since 1929 in directing the fortunes of the Council.

Projectionist Units Continue Educational Sessions

DESPITE the economic character of the times, many Local Unions are continuing to hold educational sessions. The latest to report the continuance of a school is Local 96 of Worcester, Mass., which sponsors an educational session every Monday evening. Professor Locke of Worcester Tech. is serving this class as instructor, and his efforts have been productive of a 100% membership attendance. Several members of this school travel as much as 25 miles to and from the sessions, reports business representative Jack Hauser, who places the cost of the sessions for 45 men at about 20 cents per man weekly.

Many other Locals are sponsoring educational sessions, particularly those units which are making a drive to secure contracts for the servicing of sound picture apparatus. One Local in Pennsylvania informs this publication that as a result of offering a complete service and projection contract, several houses which have been unorganized for two years or more have been regained. San Francisco Local, ever progressive, is now handling the servicing for about 15 theatres and expects soon to double this figure. An Ohio unit recently won its first servicing contract, and the exhibitor now is ballyhooing the benefits of centralized responsibility for both projection and servicing work.

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feature permits of the installation being made close against the wall.

High Fidelity Photophone equipment is new in every detail and, therefore, advantage has been taken of experience to date in sound equipment operation to eliminate troublesome features in equipments of previous design. Parts that have been subject to rapid wear, such as bronze bushings, have been replaced with ball bearings. These will have almost unlimited life and if ever in need of replacement, the operation requires only a few minutes with a screw driver.

The projectionist should find this equipment more convenient to operate and to be free from minor troubles which have caused annoyance, such as dirt and wax in sound gates. High fidelity reproduction is obtained with fewer chances for variations in the sound than has been possible with a lower standard of reproduction on previous equipments.

"HIGH FIDELITY" INSTALLATIONS

RCA Victor High Fidelity sound equipment has been installed in five large Indiana theatres formerly managed by Publix Circuit and now operated by the original owner. The houses include the Paramount in Marion, the Paramount in Hammond, the State in Anderson, the Rivoli in Indianapolis, and the Granada in Indianapolis.

Review of FUNDAMENTALS OF SOUND

The probability that projectionists will shortly extend their activities to include the servicing of sound picture equipment has generated renewed interest in the fundamentals of sound recording and reproduction. Each month in this department will appear material which will serve this interest.

IV. Elementary Electricity

IN SPEAKING of "alternating" and "direct current" the problem immediately presents itself—just what is meant by these terms "alternating" and "direct" as applied to electricity? What is termed *a "pure direct current" is a very steady, even flow of current in one direction,* such as is obtainable from a battery.

An alternating current, on the other hand, *flows first in one direction, dies out completely, and then flows in the opposite direction.* This reversal of the current is not an immediate or an instantaneous one, but is a gradual change from one condition to another, similar to the action of wave motion previously described. The current, beginning at zero, gradually builds up to a maximum value whereupon it dies down to zero, and then reverses in direction and builds up to a similar maximum value in this opposite direction.

If we were to draw a figure to represent this action it would be similar to Figure 8. In this figure, the distance along the horizontal line represents the interval of time during which measurements of current or voltage are taken. Distance measured vertically indicates the value of voltage or current at the time indicated by the corresponding horizontal distance at which the vertical measurement was made. This curve shows that the voltage, beginning at "A", increases to a maximum value and then falls to zero. The fact that the voltage is in the reverse direction in the next period is indicated by the portion of the curve drawn below the zero line. This does *not* indicate that the voltage is less than zero, but shows only that it is reversed.

Voltage Frequency

After building up (or down, as shown by the curve) in this reverse direction, the voltage falls (shown by a rise in the second loop of the curve) until it reaches zero again at "B". This action (shown from "A" to "B") represents that of a single cycle of alternating voltage or current. Each cycle consists of two pulsations in opposite directions. Figure 8 illustrates two complete cycles. The number of times per second that this action, as represented from "A" to "B", takes place is called the *frequency* of the voltage, or current, and is expressed as a certain number of cycles. The frequency of most power systems is 60 cycles, meaning that the current flows back and forth 60 times (120 pulsations) per second. Frequencies of 25, 40 or 50 cycles are supplied by some power companies, necessitating the use of different equipment from that supplied for use on 60-cycle systems. The reasons for these differences will be explained later.

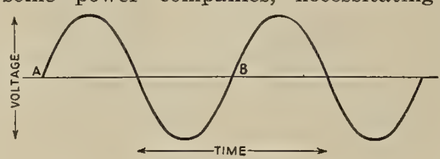


Figure 8

Direct current is more suitable for certain purposes than alternating current, and conversely, alternating current is better suited for other purposes. Direct current motors are used when variable speed is required, such as in street cars, elevators, etc. For most other purposes AC motors are usually preferable because of their greater simplicity. Until very recently, direct current has been required for vacuum tube amplifiers, the power supply for this type of equipment being obtained from batteries, motor-generator sets or rectifiers. A rectifier is a device for changing AC to DC without, ordinarily, the use of rotating machinery.

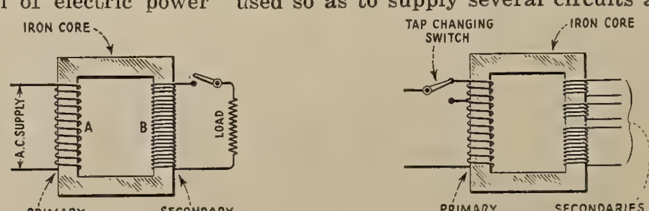
Alternating current is best adapted for the transmission of electric power because of the ease with which it can be changed from one voltage to another. This is important because electric energy cannot be transmitted efficiently over long distance except at high voltages. Therefore, it is necessary to raise the voltage for transmission and reduce it again where it is used, and, at present, no simple method has been devised for changing DC voltages up and down for transmission purposes. A common device for changing AC voltage is known as a *transformer.*

Transformers: Their Nature and Application

A transformer usually consists of two separate windings on an iron core (Figure 9). It was stated previously that when a current is passed through a wire a magnetic field is formed around the wire, and if an iron bar is placed in such a field it is magnetized. Magnetic lines of force were described. These lines extend through the iron as well as through the air, and they form in closed loops, parts of the loops being in the iron and parts of them being in the air. If the entire path is in iron, *i.e.,* if we have an iron ring, the number of lines of force are increased because it requires less magnetizing force to produce lines of force in iron than in air. Previously it was stated also that if the lines of force which passed through a loop changed in number, a voltage would be generated in the loop.

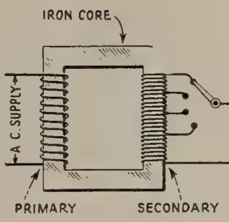
Referring to Fig. 9 (a), if an alternating voltage is applied across the terminals of coil "A", an alternating current will pass through the coil. The current will set up lines of force through the iron, and the number of lines of force set up will be proportional to the current in the coil at any instant. Since the current is constantly changing, the lines of force will be constantly changing also. Coil "B" is a series of loops connected together, so we should expect to have a voltage generated in coil "B" when an alternating current was flowing in coil "A", and such is the case. If coil "B" is closed through an external circuit similar to that marked "Load", current will flow in the load circuit. Coil "A", or the coil to which the alternating current is supplied from an outside source, is called the *primary.* Coil "B", the coil in which the voltage is generated by the transformer action is called the *secondary* of the transformer. Instead of having only one winding on the secondary, any number (within practical limits) can be used so as to supply several circuits at

Figure 9

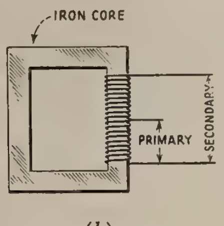


(a) (b)

Figure 10



(a)



(b)

different voltages as shown in Fig. 9 (b).

The voltage generated in the secondary winding depends on the ratio of the number of turns of the secondary compared with the number of turns of the primary. If the secondary has twice as many turns as the primary, it will have twice the voltage of the primary; or, if it has one-half the number of turns of the primary, it will have only one-half the primary voltage. It is therefore possible to obtain any desired voltage within quite a wide range.

If the primary voltage is less than the secondary voltage, the transformer is called a step-up transformer; and if the primary voltage is greater than the secondary, it is called a step-down transformer. Some transformers are provided with a tapped primary [Fig. 9 (b)], for the purpose of adjusting the transformer to the supply voltage. By using the proper tap, the ratio of the number of secondary turns to the number of primary turns is adjusted to give the proper secondary voltage when the supply voltage is too high or too low. When it is desirable to have the secondary voltage variable over a considerable range the secondary is sometimes tapped [as in Fig. 10 (a)]. The secondary may have several separate windings all insulated from each other [Fig. 9 (b)], and the voltage generated in each secondary winding will be independent of the voltage generated in the other secondary windings; in other words, each secondary winding behaves as though the other secondary windings were not present.

Other Types of Transformers

Another type of transformer, called the auto-transformer, is sometimes used. In this transformer both the primary and secondary windings used some turns in common. The same laws regarding the voltage ratio of the windings hold for the auto-transformer as for transformers where the windings are entirely separate. As shown in Fig. 10 (b), the primary uses only a fraction of the total number of turns, while the secondary uses all the turns of the winding. This condition could just as well be reversed. The connections used depend upon the voltage change desired.

The figures used in conjunction with this discussion of transformers show the primary and secondary windings on different legs of the iron core. In practice the windings may be as shown, but they are usually wound one on top of the other. One method is about as good as the other so far as operation is concerned, and all the statements made regarding transformer action are true for transformers in which the primary and secondary are on the same leg of the core, as well as when they are on separate legs.

Transformers used to transform the voltage of power circuits are known as "power transformers." Transformers used to change the voltage of speech frequencies are known as "audio transformers." The electrical action in both types is the same. The difference arises from the difference of the frequencies involved and the use to which the transformers are put. A power transformer should not be used on circuits of lower frequency than that for which it was designed unless the primary voltage is reduced a corresponding amount, that is, a 60-cycle transformer with a 110-volt primary should not be used on a 110-volt, 25-cycle circuit, because it would become overheated and burn out.

If a 110-volt DC circuit was connected to a 110-volt primary of a power transformer, the transformer would probably burn out immediately, and the current would be over twenty times the current for which the primary was wound. Therefore, it is evident that direct current and alternating current behave differently in certain types of circuits. It was implied in the discussion of Ohm's law that resistance alone limited the current in DC circuits, but it is evident from the behavior of DC in transformers that there is some other property that limits the alternating current in a transformer circuit. This property of the transformer circuit which limits the alternating current is known as *impedance.*

Impedance Factors

Impedance is the name given to that property of any electrical circuit which limits the current flow in the circuit when a voltage is applied to its terminals, and is made up of three factors: *resistance* (already described for DC circuits under Ohm's law), *inductance*, and *capacity.*

The pure resistance of a circuit to an alternating current is the same as to a direct current.

Inductance does not affect a direct current but has considerable effect on an alternating current. When a current flows in a conductor a magnetic field is formed around the wire in proportion to the strength of the current. If the conductor is in the form of a coil, a strong magnetic field is produced, and, if the coil is wound on an iron core, an even stronger magnetic field is set up. When a magnetic field is created the number of lines of

(*Continued on next page*)

force through the coil producing the field must increase, but if the number of lines of force through the coil is increased, a voltage will be generated in the coil. The generated voltage opposes the applied voltage and prevents the current from increasing rapidly. This property of a circuit which prevents a rapid change of current is called *inductance.* Inductance can be considered as an electrical inertia.

From this discussion we see why the rapidly changing alternating current does not reach a destructive value in a transformer, while the steady direct current increases rapidly to a value limited only by the pure resistance of the circuits. Coils wound for use in circuits to offer a high impedance to an alternating current, while offering a low resistance to a direct current, are called "inductors" or "reactors." Such devices are used in certain types of amplifiers, or in the filter circuits of socket power units used to supply the DC voltage for the amplifiers.

The third type of impedance is *capacity,* and the device used in obtaining this type of impedance is called a condenser. A condenser will not pass direct current but passes alternating current in proportion to the frequency of the applied voltage. Condensers are used in the filter circuits of socket power units and, when so used, act as reservoirs to absorb ripples in the direct current and thereby smooth out its flow. Condensers are also used to prevent the flow of direct current while passing the desired alternating current, and when used in this manner they are called by-pass condensers.

(To be Continued)

S. M. P. E. PROJECTION SCREENS COMMITTEE REPORT

(*Continued from page* 16)

stoning at the edges; but, of course, it will not improve the distortion within the image itself. A thorough exposition of these factors, with an estimate of their seriousness, would be an important contribution to motion picture engineering science. The Committee therefore proposed to one of its members that he undertake the preparation of a paper on the subject. Mr. Clifton Tuttle prepared a paper on the subject for presentation at the Spring Meeting of the Society.*

The Committee has been seeking for some time a simple, practical method for exhibitors to determine the reflectivity of their screens. The most feasible method at the present time appears to be a direct comparison of the screen with samples of paper having known reflection values. The brightness of each sample is compared with

(*Continued on page* 27)

*"Image Distortion," presented at the Spring, 1933, Meeting at New York, N. Y.

THIS "ILLUSION OF DEPTH" IN PICTURE SCREENS

THREE-DIMENSIONAL motion pictures, like television, have suffered more than they gained through extensive publicity. Relative to the former, certain screen manufacturers have tried to capitalize the interest displayed in the art by intimating that their products give an "illusion of depth," or, as one manufacturer expressed it, actually give a "three-dimensional effect."

Those who have followed the painstaking researches of Dr. Ives of the Bell Telephone Laboratories cannot help but contrast the public pronouncements of this distinguished scientist with the foregoing statements of manufacturers, a majority of whom are "manufacturers" in that they merely receive the screen fabric, sew it together and ship it off to the theatre. The possibilities of securing either "illusion of depth" solely through the utilization of the "proper" screen were pretty well established by the following statement of the Projection Screens Committee of the S. M. P. E.[1]:

"From time to time there has been exaggeration in statements made by individual manufacturers (of screens), concerning the superiority of their product. Screens have been claimed to remove distortion, create three-dimensional effects, and heighten illusion. The Committee would like to go on record, stating that there is little or nothing to these claims. A picture projected on a plane screen when viewed from an angle will appear foreshortened horizontally, and the type of reflecting surface on the screen will not alter the situation; if projected at an angle, the figures will be further elongated.

"As for stereoscopic effects, it is impossible that a flat surface, reflecting pictures made in the ordinary manner, will reflect anything but two-dimensional views, and in any case only what is projected upon it.

"Judging from recent papers on the subject, three-dimensional projection is possible only with special prints and probably special projection or viewing apparatus. A screen has now power to differentiate between background and foreground objects, influence their relative position, or produce binocular vision from monocular photography. Its quality must be judged by the nature of its reflecting surface (of course, also, by mechanical, acoustic, and maintenance considerations, these being extraneous to this particular discussion). As for illusion, a screen, that reflects an image that can be comfortably observed, will probably be said to heighten illusion in the sense that it does not cause distraction."

[1]Journal of the S. M. P. E., Vol. XIX, No. 2, August, 1932, p. 191.

PROPER MERCHANDISING OF UNION LABOR

INCREASED purchasing power, it is maintained by Miss Frances Perkins, Secretary of Labor, is the key to economic recovery. This belief she voiced in hearings on the Black bill, and declared that reduction in the length of the work week would spread employment, while a minimum wage in industries where earnings had fallen below "a fair value for services rendered" would bring increased purchasing power.

But a minimum wage, desirable though this be, should not be allowed to become a maximum wage. Organized labor must be ready, alert, militant, to start wages on their upward climb. First we must have the most stubborn resistance to any further wage cuts. Then we must have the zeal, the courage, the united organization to press on for wage increases, because increases we must have, to make up for the drop in pay in the last three disastrous years; and finally, if the value of the dollar drops, we must have more dollars.

Higher Standards Necessary

Everyone who has studied modern economics knows that to absorb the products of myriad machine processes, we must have a constantly improving standard of living. The people who are living in shacks must be able to move into modern houses; people in rags must be able to buy good clothes; those who walk must ride; those who drudge must be given leisure. No mat-

ter how it hurts our heads of corporations to see workers in automobiles, in nice homes with modern conveniences, enjoying the comforts of life, their own sales managers will tell them that workers must be able to buy these things if prosperity is ever going to come out of that corner. And who is going to make it possible for millions of poor, bankrupt workers, who have lost everything they ever had, to buy anything more than the barest necessities, even if it is possible to give them jobs, if prices rise and wages stand still?

There is only one agency that is really effective in raising wage rates and that is organization. The more free and the more widespread this is, the more effective it can be.

To the old-time unionist, organization was like a religion. With religious fervor he preached his faith and made his converts. Now people are interested in material things to a very great extent. Organization has to be presented with its dollars and cents advantages, as good business not only for the worker but for the merchant, the manufacturer, for everyone who has something to sell.

An Antagonistic Press

If you read newspapers and magazines you know that there is almost a universal prejudice against unionism in the commercial press. This is not merely a prejudice, it is a policy with the owners of the big newspapers, the publishers of the big magazines, always to put organized labor in a bad light, to make it appear ridiculous, or worse. The joke about the plumber forgetting his tools is an example.

Why shouldn't we, who benefit from organization, take the initiative for a campaign of education for people whose ideas of unions are contaminated by the commercial press? Our future standard of living is at stake and so, though they do not realize it, is the standard of living of all who live on their earnings. In our daily contacts we can find the opportunity to explain to people what unions stand for and the good they do.

The union label has gone into society with Mrs. Roosevelt, who insists on buying her own clothes at union shops; and with this example we surely should renew our efforts to buy only union labelled merchandise. Every time we buy union made goods it spreads organization.

Mrs. Roosevelt, recently, in discussing the Women's Trade Union League campaign for better conditions in the women's apparel trades, said something that has a general significance for labor:

"Any movement of this kind to be successful, must have the backing of the mass of women. Therefore, the problem is how are you going to get at the mass of women to awaken in them the interest necessary to bring about success.—*Electrical Workers' Journal.*

S. M. P. E. PROJECTION SCREENS COMMITTEE REPORT

(*Continued from page* 24)

the brightness of the screen; the reflectivity is determined from the sample whose brightness most nearly matches that of the screen, the several samples being calibrated in terms of reflectivity. The information so obtained, while not strictly accurate, is reliable enough to give the exhibitor, in a simple manner, the information he needs. It can serve either as assurance that all is well, or as a warning that his screen should be resurfaced or replaced in order to avoid excessive waste of light. With screens of the beaded and diffusive type, this simple comparison principle will not be very satisfactory because of the specular nature of the reflection.

To illustrate the method, there are incorporated in this report four samples of paper having the following graded reflectivities: 0.78, 0.64, 0.56, and 0.40. The values chosen were determined partly by the availability of the papers and partly with the thought of achieving a scale on the basis of which a screen might be called good, fair, poor, and definitely unsatisfactory.

Screen Brightness

The proceedings of the "Commission International de L'Eclairage," eighth session, published in Cambridge, England, were recently brought to the attention of the Committee. These proceedings contain reports of German and Japanese sub-committees on theatre illumination which should be of interest to American motion picture engineers.

The Japanese sub-committee recommended that the general illumination of the theatre be not less than the amount required for reading programs printed in 8-point type. The value proposed in compliance with this requirement is about 0.18 foot-candle. This compares with 0.1 foot-candle found by the Theatre Lighting Committee[1] in 1931 to be adequate for locating seats easily after the eyes of the patron had accommodated themselves to that level of illumination. With the auditorium light at 0.18 foot-candle, the Japanese found that a screen illumination of 9.3 foot-candles was sufficient to preserve picture contrasts, with higher values not objectionable. This finding included the observation that care had to be exercised to prevent auditorium light sources from illuminating the screen directly and from shining into the observers' eyes.

According to the report, measurements made in eleven of the principal theatres of Tokyo showed screen illumination varying from 3.1 to 9.8 foot-candles, without film and shutter. The average was 6.35 foot-candles, considerably below the recommended value. In comparing these values with measurements made in America, it must be remembered to differentiate them from those of our measurements made with the shutter running. Shutters reduce the average brightness by 50 per cent, although the brightness during the illuminated intervals remains unchanged. The reflectivities of the screens were comparable with those of American types of screens.

The German sub-committee reported that it is not customary in their country to provide any general illumination other than that furnished by reflection of projected light from the screen. Screen illumination measured in ten theatres varied from 6 to 16.8 foot-candles at the screen centers, presumably without film, shutter condition not mentioned. The corresponding values for screen brightness ranged from 2.61 to 9.6 foot-lamberts.

Perforations in Screens

The acoustic transmission characteristics of screens are being re-exam-

[1]"Report of Theater Lighting Committee," *J. Soc. Mot. Pic. Eng.*, XVI (Feb., 1931), No. 2, p. 239.

ined, relative to recent developments on extended recording and reproduction frequency ranges. Difficulties are anticipated for only the higher frequencies. When the Committee first reported on the subject of screen transmission, it included the statement that screens that are satisfactory up to 6,000 cycles are usually found to attenuate less than 4 db. at 10,000 cycles. Inasmuch as this value does not represent excessive attenuation, and since lesser amounts would be difficult or impracticable to obtain with commercial screens, the Committee feels that it can recommend it as representative of good practice. Some screens hitherto adjudged satisfactory will not be altogether acceptable for use with reproducing systems of wide frequency range.

There has been considerable discussion as to the advisability of devising some means of eliminating the necessity for perforations in screens. Both sound transmission tests and acoustic theory indicate the necessity for perforations. Recently, tests were made at the Bell Telephone Laboratories on a series of screens identical in all respects except as regards the number of perforations. One screen, without any perforations whatsoever, showed excessively large attenuation, especially at high frequencies. The others, with graded amounts of open area, showed increasing efficiency of sound transmission.

Since it is thus evident that perforations are necessary when the loud speakers are placed directly behind the screen, the question arises as to whether it would be possible to place the loud speakers to one side of the screen. In the past, this method has been tried and apparently found wanting, inasmuch as the practice has been discontinued. One difficulty was loss of illusion; another was that the method lacked the mechanical simplicity and flexibility inherent in "flying" the speakers, or mounting them on towers behind the screen so that they could be removed at will. The present standard method seems to meet most operating demands comparatively satisfactorily, although it also has its disadvantages.

One objection to the perforations is the loss of screen brightness that they cause: 5.8 to 8.5 per cent, depending upon the make of the screen. This loss is, of course, undesirable, especially when the available illumination is already scant. Another objection sometimes offered is that the perforations may be visible from the auditorium and thus mar the appearance of the projected picture. However, when the limiting distance for the visibility of the holes is computed from their diameter and the known resolving power of the eye, it appears that this consideration will be usually unimportant. A large value for the diameter of the perforations is 0.0625 inch; the resolving power of the eye may be taken as 1 part in 3,438.[2] The limiting distance at which the perforations are just discernible is, therefore, 18 feet. Many makes of screens have perforations of smaller diameter which are, therefore, visible only within correspondingly shorter distances.

[2] HARDY, A. C., AND PERRIN, F. H.: "The Principles of Optics," *McGraw-Hill Book Co.*, New York, 1932.

PRODUCTION PROCESS FOR ANIMATED CARTOONS

(*Continued from page* 13)

used more than three times, because the surfaces become badly scratched and marred when used more often. Also, after the third time, the celluloid becomes discolored, an effect impossible to control by means of the paint. Also, as the celluloid ages, shrinkage becomes a serious factor, preventing the sheets from fitting properly over the registering pins.

Photographic Process

After the celluloid sheets are completed by the Painting Department, they are turned over to the Camera Department for photographing. A standard camera is employed, equipped with a stop-motion mechanism driven by a synchronous motor. The camera can be moved vertically to change the size of the field as well as from right to left (east and west), fore and aft (north and south), and rotated through an arc of 360 degrees. The optical center of the camera is oriented by means of a "camera field chart."

The celluloid sheets representing the action of a single frame of the picture are assembled and placed over the background of the scene. The "cels" are held in position by registering pins. An optical glass plate flattens the "cels" against the background, thus removing any wrinkles or curl. The glass plate is operated by a compressed air mechanism.

100 *Hours of Camerawork*

If less than four "cels" are required for the action, blank "cels" are added so as to preserve the photographic values of the background. Four "cels" are always used between the camera and the background. The camera operator follows the instructions outlined on the exposure sheet. Approximately 100 hours are required to photograph a cartoon subject, which averages about 600 feet of film. If the subject should contain more than the usual number of so-called "trick" shots, which may require complete camera adjustment for each frame of film, the shooting time will easily run from 125 to 150 hours. During the time consumed in animating, inking and photographing the picture, the musical score is completed and arranged, and the sound record is made. It is not necessary for the purpose of scoring to see the picture. As the musical score is prepared in accordance with the same tempos as those used in drawing the pictures, the musical director knows exactly at what frame

in the picture every musical note or sound effect will occur.

Not only are parts writen for all the instruments in the orchestra, but each trap drummer, or effect man, is supplied with a score that is as complete in detail as is the part for the first violin. The position of the effects is written on the score as musical notes, postscripts being added to describe the kind of sound or effect required. The trap drummer must be able to read music and to assign proper values to the sounds as indicated by the musical notations.

Each member of the orchestra, as well as the conductor, is provided with a head-phone similar to that used by telephone operators in which is heard the tempo of the music to be played. This beat is developed by means of an audio-frequency oscillator controlled by a synchronously-driven contracting device, which makes and breaks contacts in terms of frames of synchronously running film. Experience has shown, after trying perhaps every known method of achieving perfect synchronism, that the aural process thus employed is as nearly fool-proof as any system could be. The Disney Studios were probably the first to synchronize cartoons by projecting a wavy line to be used as a tempo guide, or the use of the bouncing ball. These two methods were abandoned, after a brief trial, in favor of the present method.

For scoring the cartoons, there are employed an orchestra ranging from twelve to twenty musicians and four, and sometimes five, effect men for producing sound effects, in addition to the vocal artists. To synchronize the orchestra is relatively easy; the greater problem is to synchronize effects, because of their unmusical character and irregular occurrence. The effect man has quite a problem, as he sometimes has on his table dozens of sound-producing devices, which he must pick up and operate at very definite places in the score. With the aural method of controlling synchronism, he is constantly aware of the tempo, and his attention can be concentrated on his musical score and effects. It is not necessary for him even to follow the lead of the conductor, except at the start. The actual recording technic is approximately the same as used to record any orchestra.

Cutting the Cartoon

To facilitate cutting the sound track, acoustical beats are recorded at the beginning and at the end of the take. These beats are controlled by the musical director. A predetermined number of beats are produced in synchronism with the controlling tempo, followed by a predetermined time interval in which no sound occurs, preceding the first bar of the music. This enables the cutter to determine, with absolute accuracy, the exact start of the sound take. It is quite possible, and has been the practice of this studio, to assemble the sound track from these visible indications on the film, assemble the picture negative from the exposure sheets, attach academy trailers, and make a composite print. Errors in the synchronism are due to errors in supervision.

The dialog is handled in a somewhat different manner. In the case of dialog that does not follow the tempo of the music, prescoring is necessary: the dialog is recorded before drawings of the subject are made. The recorded sound track is sent to the Cutting Department, where a careful analysis of the position on the film and of the various speech components is made; such components being translated into terms of frames on an exposure sheet. The exposure sheet then indicates to the animator the exact position of each and every syllable in the dialog and the drawings are made to fit the particular conditions.

In the case of musical or rhythmical dialog, it is possible for the animator to make suitable drawings for the words to be used, and in this case the dialog is recorded at the time the orchestra recording is made. This form of dialog is one to be avoided, as in the finished product the composite result sometimes lacks realism; whereas in the first method of prescoring it is quite possible to make the audience feel that the cartoon character is actually talking.

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Yours very truly,
John Lagalo
Projectionist

JL/HG

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International PROJECTIONIST

Edited by James J. Finn

June 1933
Vol. 5, No. 4

A magazine devoted to better visual and sound reproduction

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INTERNATIONAL PROJECTIONIST is not responsible for personal opinions appearing in signed articles in its columns.

MONTHLY CHAT

WE repeat our warning of a year ago: Warm weather is here. Don't let yourself be crowded into a hot, stuffy projection room. Insist upon adequate ventilation. If cooper- tion is not forthcoming, look up the law on this matter in your territory. Take care of that one life of yours. And when you leave the projection room don't head for a couch or a hammock, or plunk yourself into an automobile seat. Take a walk in the park.

GHOSTS from the almost forgotten past: double reels as a universal standard; square vs. round aperture corners; television "in every home by Fall" (1931); three-dimensional motion pictures, in color and to benefit by the release of "appropriate odors"; a worth while projectionist organization, blocked by the shortsightedness, if not actual stupidity, of members of the organized craft; acceptable volume control in theatres; wide film—and vaudeville.

The double-reel standard still is a live issue, of course, awaiting only the concerted action of a number of distributors who now are thinking about something else. Those opposed to such a standard may be expected to remain glum and not squawk until the matter is over and done with.

THE industry is excited about the effects of the National Recovery Act. Producers, distributors, and exhibitors are working feverishly on the formulation of an acceptable code. So much wasted effort, as we see it, because the chief concern of the Act is putting people to work and not the placing of a governmental stamp of approval on industry hokus-pocus. More on this question elsewhere in this issue.

Also within these pages is the final report of the National Research Council of Canada on what has come to be known as the two-men projection shift question. These Canadian projection fellers certainly show up their brothers in the U. S. A.

REPORTS of an extension of servicing activities by projectionists continue to filter in to this office. Still, we are far from satisfied with the progress made by the craft to date. Each unit seems to be floundering along on its own, with no very definite idea as to what is wanted or how to get it. Meanwhile independent servicing companies, employing men not affiliated with any craft, continue to gain theatres every day. A swell opportunity is passing projectionists by.

Sound equipment servicing work is the best insurance of keeping projection work.

The IP EDITORIAL PAGE

Vol. 5, No. 4 JUNE 1933

Canada Shows the Way to Better Projection

Substituting organized fact-finding for the rabid rantings of exhibitors, the National Research Council, Canadian government subsidiary, has reported the results of its investigation into conditions affecting the efficient and safe operation of projection rooms. This report is printed in full elsewhere in this issue. The personnel of the committee which conducted this investigation is such as to dispel any doubt as to its ability and impartiality, which serves to make the Council report such an important addition to projection literature as to warrant the serious attention of projection organizations everywhere, and particularly those in the United States.

We find ourselves in agreement with the Council report overall, the most significant feature of which is the finding that a projectionist should be stationed at the side of every operating projector and not engage in any other room activity. This finding is in accord with well-informed opinion on the subject. Certain other features of the report warrant more than passing attention.

Noteworthy is the incorporation in the report of the exhibitor objection that the Unions' insistence upon qualified men and the maintenance of proper room standards, operates to the "great disadvantage of the theatres." The implications of this complaint are plain: the Unions are cornering the supply of quality men. What a crime! The U. S. Bureau of Standards is credited with the statement that film can be ignited by a carbon arc in one-half second. The importance of worn parts and defective equipment is recognized as running a close second to the ability of the projectionist as a vital factor in fire prevention. Proper first training and continuing study make a first-class projectionist, states the report. "Safety devices", often characterized in these columns as futile fire-prevention aids, are declared to be useless in the event a film jams in the projector or a patch comes apart.

Section 5 (b), of the report surprises us by stating that the abolition of discs and the consequent advancement in sound-on-film technique provide an "automatic adjustment of sound level". This is news to us, our position being that volume control still is as conspicuous by its absence in 99 per cent. of all motion picture theatres as it was in 1927-8. Service engineers are credited with having effected an improvement in equipment; but since such workers are concerned only with the sound apparatus, we do not agree with this finding. Film should be rewound only by hand, providing an opportunity to inspect for tears, scratches and loose patches.

The position of the S. M. P. E. as the standard-setting and fact-finding body in motion picture technical matters is recognized by the Council, the report containing many references to S. M. P. E. standards as the ideal. Prevailing practice in the United States failed to weigh heavily with the Council, for the reason that there exists no central bureau for the clearing of authentic information on such topics. (We wonder whether the organized craft considers this a matter of importance. Probably not.) The report delivers a crushing blow to those who oppose high standards for projectionists by endorsing the idea of (1) selecting only capable men for projection work, and (2) providing a means for keeping projectionists abreast of developments in their work.

Recognition is accorded the right of the paying patron to enjoy the very best projection work possible—which statement may very well stand all alone and not be tied-in with any consideration of safety factors. Emphasis is placed upon the ever-present possibility of an acute emergency situation developing as a result of fire, and the second projectionist on the shift is characterized as an insurance policy against possible calamitous results of such situations.

International Projectionist congratulates the National Research Council of Canada on this splendid piece of work. So much heated air has been expelled on this topic that the vital factors involved have been all but obscured, to the great detriment of projection in particular and show business in general. To those Canadian units of the organized craft, and in particular to their leaders, is due the thanks of projectionists. These men have in this instance again proved that for true unity they are the stand-out members of the profession.

Labor and The National Recovery Act

Projectionists are unduly excited, we think, about the probable effects of the National Recovery Act upon their daily work and weekly wage. The industry trade papers reflect a feverish activity upon the part of other industry groups—production, distribution, and exhibition—to get together and agree upon what will serve as an industry code. Undoubtedly there are many policies and practices within the motion picture industry that are sadly in need of an overhauling, if not elimination. But the industry press seems to have overlooked the obvious fact that the primary interest of the National Recovery Act is the welfare of the laboring class, the spread of employment and a more equitable distribution of money in the form of wages, minimum scales of which will be set and observance of which will be insisted upon. Every statement of policy from the directors of the Act has served to emphasize this fact.

The very worst that Labor may expect from the administration of the Act is a better deal than it is now getting. It is not inconceivable, of course, that poor representation of a given craft's position before the Labor Board might result in something less than a good deal, but the possibility of such an occurrence appears remote at this time. Labor itself will be expected to make certain changes of its own accord. Unions will probably be expected to abolish work lists upon which appear the names of those who must sit on the bench and await the appearance of a job, which means that all members of a Union will have to get an equal amount of work, resulting from a more even spread of hours of labor.

Industry codes will pass in seemingly endless review before the executors of the Act in Washington, but Labor need not be unduly alarmed as to the ultimate results. Thus will be vindicated the opinion of Abraham Lincoln who declared: "Without Labor capital could not exist. Labor, therefore, is by far the more important of the two."

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TROUBLES ORIGINATING IN THE P.E.C. AMPLIFIER

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EXTRANEOUS noise is the bane of good sound reproduction and one of the most serious difficulties with which the projectionist has to contend. Sometimes such noise is only a faint ticking or rushing sound; sometimes it is so bad that the show must be interrupted. The chief difficulty lies not in correcting such trouble but in locating it.

Careful manipulation of the fader or the gain control sometimes is very helpful in determining where such noise originates. The effect in the theatre of such procedure is none too good, but this method has one redeeming feature in that it facilitates discovery of the trouble. Raise the fader as far as you dare, then lower it as much as possible and yet be able to hear the sound. While doing this, notice whether the noise varies in volume the same as the desired signal does, or if the noise remains at the same level while the signal goes above the noise and then drops below it when the fader is turned down.

Obviously, if the noise stays at a constant level it is not affected by the fader and it therefore originates at some point further on in the system. Should the noise vary as the fader is moved, it shows the trouble to lie ahead of the fader.

Common Trouble Sources

Most noises originate ahead of the fader. This is due to such things as vibration of the machine, affecting all parts of the photo-electric cell amplifier; the optical system and the exciting lamp, difficulties at the sound aperture, and the low level of the signal. Assuming that the signal applied to one of the tubes in the p. e. c. amplifier is .1 volt. It is quite likely that a loose connection in the amplifier would put an unwanted signal (noise), on this grid easily amounting to .1 volt and often much more. The signal and the noise would be amplified to the same degree, thus the sound in the horns will consist of as much or more noise than signal. The signal voltages on the grids of tubes in the power amplifier stages run much higher. Suppose the voltage on one of the grids is 20. If, through a fault in the amplifier or outside trouble, a noise is introduced causing a change of .1 volt on this grid, the noise produced in the horns will be so slight that it will be impossible to hear it.

This comparison shows the vast difference produced in the horns by impressing the *same amount* of noise in the p. e. c. amplifier and in one of the power amplifiers. It must be remembered that the *level* of the noise introduced in the final stages will probably be higher than the level of the noise introduced in the p. e. c. amplifier, but it very seldom is so great that it will produce noise in the horns comparable to that originating earlier in the system.

If a change-over is about to be made, one can often tell in what part of the system the noise is by noting if it stops when the sound is switched over to the other machine. Should the noise stop it is quite certain that it originated in the outgoing machine. However, if it does not stop, it is not

conclusive proof that it was not in the outgoing machine, especially if a motor-generator set is used to supply the p. e. c. amplifier. If the m. g. set is noisy, it affects both machines. So does any other common equipment, including batteries.

Exciter Lamp Troubles

The new "peanut" tubes have reduced microphonic noises to a minimum, and it is seldom that this trouble is encountered nowadays. Another form of noise is due to the adjustment of the exciting lamp. The spot at the photo-cell will look clear on a card placed there, but the ribbon of light may be just barely covering the slit. When the machine is running under these conditions the filament of the exciting lamp vibrates up and down with the result that the light on the slit moves up and down, causing the slit to be in a shadow part of the time. The filament moves in synchronism with some vibration of the machine, usually that of the gear teeth, and thus modulates the light beam at the slit. This produces a sound in the horns like the whine of running gears. If the eye were fast enough it could see these variations on the card placed before the cell.

Many projectionists are now making the final adjustment of the exciting lamp while the machine is running and with the fader set at 15—the final position being the one that produces the least "machine noise." A loose optical system or a slit that is loose could cause the same sort of noise, along with various other troubles.

Light Beam Adjustment

Most projectionists are familiar with noise due to the film not being in line with the beam of light from the exciter lamp, either motor-boating, on the one hand, or a noise like fog horn on the other. If the adjustment cannot be made immediately, it is possible to push the film to one side or the other so as to eliminate the noise until the reel is over. It can then be lined up by the familiar method of using white leader and photographing the slit image, then shifting the guide rollers or the lens, whichever a particular system requires, until the light strikes as it should. If any doubt exists as to the proper adjustment and there is enough time, some film can be put on the noisy machine and the sound can be heard by placing a pair of phones across the output of the p. e. c. amplifier while the machine is running for the test. The least trace of motor-boating or fog horn can be heard during an otherwise silent portion of the film.

Dirt in the sound aperture comes in for its share of attenion as a source of noise. A hair flipping back and forth across the light can produce some "wonderful" effects. Dirt actually in the aperture usually only reduces the volume, which in itself is serious enough, but at times it will keep the film from running down in the plane of focus, causing a loss of the higher frequencies and making the sound "boomy." This is more apt to happen when running new film, the emulsion sticking to the tracks in the sound aperture. This may also rough up the sound, causing flutter, due to the film chattering on its way past the light beam.

Loose Connections

Any insecure connection is a potential source of noise—the type of noise depending on the form of the connection, presence of vibration, etc., etc. A connection that makes a light contact and is subject to vibration is likely to become michrophonic, producing a whistle, clicking or grating noise. Connections soldered with acid eventually make a hissing or frying noise, which is difficult to locate. The acid permeates everything and makes its removal a difficult job.

Batteries, resistances, transformers —in fact, any of the component parts —may become noisy. Headphones are about the best thing with which to find noise. Batteries are tested by connecting the phones across them. The noise is heard as clicking, frying or hissing. In testing other parts a battery is hooked in series with the phones and the combination is connected across the part to be tested. A suspected connection is treated in the same manner. In making these tests on parts in the p. e. c. amplifier it is a good plan to leave them in place but disconnect other parts that interfere with the test electrically, apply the phones and run the machine, so that normal vibration is present during the test.

Some people disapprove the practice of placing phones directly across a 45-volt battery. Personally, I do not know if it is harmful, but I do know that I have never seen a pair of phones injured in this manner, at least so far as was possible to tell by subsequent use. Of course, I am speaking of 2,000-ohm phones. A 60-ohm phone would probably be damaged. Anyway, it is not nearly sensitive enough for the type of testing projectionists must do.

One other precaution: some parts would be ruined by placing a comparatively heavy direct current through them. Such parts are the disc pick-up and transformers having permalloy cores or similar metals. All of Erpi's speech transformers are of this type. However, the transformers in the 42' and the 43' will not be harmed by any current put through them after it has gone through 2,000-ohm phones. Use only one or two dry cells or a single cell of a storage battery with the phones when testing the transformers in the 41'- or in the p. e. c. amplifiers. A better method would be to substitute another transformer, which would stop the noise if it was in the one taken out.

GLOW VOLTAGE AND SENSITIVITY: PRIME P. E. CELL FACTORS

A. J. McMaster†

IN your studies of photo-electric cells and their properties, you have no doubt encountered two principal characteristics which determine the quality of the cell. These characteristics are sensitivity and glow voltage. The sensitivity of a cell is the measurement of cell current output at any given condition of light and voltage. The glow voltage is the voltage at which a cell glows, giving off a faint bluish light.

The sensitivity of a caesium *vacuum* cell is the true measure of quality of photo-electric cells, due to the fact that no gas is present to alter the cell characteristics. Since the current output of a vacuum cell levels off at voltages between 30 and 50 volts, depending on the amount of light falling on the cell, a dependable way to measure the vacuum cell quality is to measure it at 10 volts under light intensity similar to the light intensity normally used in the modern sound-on-film equipment.

It so happens that the true quality of a gas-filled caesium cell can be measured under the same conditions. At ten volts, and with light on the cell equivalent to the intensity found in sound-on-film equipment, the gas in

†G-M Laboratories, Inc.

the cell has no effect on the cell characteristics. Thus, by testing both vacuum and gas-filled cells under this same set of conditions, the true quality of these cells can be measured and compared. For convenience, let us call this sensitivity the inherent or basic sensitivity. Technically, it is called "specific surface sensitivity."

Effect of Gas

When an inert gas is admitted to a caesium photo-electric cell it has two effects: (1) it increases the current output of sensitivity and (2) at the same time introduces the factor of glow voltage. By controlling the amount of gas admitted the sensitivity of the cell can be multiplied as much as five times the basic sensitivity, but the greater the amount of gas admitted, the more the glow voltage is lowered.

In speaking of glow voltages there are two types of conditions under which this can be measured. The first condition, one which is of very little interest to sound equipment manufacturers, although it is frequently used by certain manufacturers of photoelectric cells, is the dark glow voltage or the voltage at which the cell glows when dark. However, inasmuch as this voltage drops considerably when the cell is subjected to light, the dark glow voltage has little significance from the point of view of the manufacturer of sound equipment. The glow voltage he is interested in is the voltage at which the cell ionizes or glows under normal conditions of use. For this reason the glow voltage used on Visitron Cells is what we call the "light glow voltage." This is the point at which cells will glow when subjected to the normal amount of light used in sound heads.

Cells of relatively low basic sensitivity can be made to give a large output at 90 volts by increasing the pressure of the gas in them, but this results in a lowering of the glow voltage so that the danger of having the cell glow during operation is greatly increased. Another disadvantage is that the reproduction from a cell of this kind is of poorer quality than from a cell having high basic sensitivity and high glow voltage. In other words, the higher the basic sensitivity the higher the glow voltage can be made and still get high output and superior reproduction. It is obvious from this then, that in gas-filled cells, high output alone does not necessarily mean high quality.

Many cells rated at glow voltages of 180 or more are rated at the dark glow voltage. Visitrons, however, are always rated at the light glow voltage which gives a truer picture of the actual quality of the cell. The higher the glow voltage, the better sound reproduction the cell will give and the longer the cell will last. Thus, although the sensitivity of the cell is the most obvious characteristic by which cells can be tested, from the point of view of the manufacturer of sound equipment a no less important characteristic is the glow voltage.

What About 'Cell Hiss'?

In the last analysis, the whole matter boils down to the basic sensitivity of the cells in question. If the cell has a sufficiently high basic sensitivity to start with, the amount of gas necessary to raise the sensitivity to a point that will give good sound reproduction will still not lower the glow voltage to a dangerous point.

As for the much-discussed "cell hiss," a term commonly applied to a hissing sound issuing from the loudspeakers, our experience has been that cells in which the output is obtained by considerable gas amplification and which have a correspondingly lower glow voltage are apt to be responsible for some of this noise; whereas other cells which have a greater surface sensitivity and which can be operated at a voltage farther below the glow point, do not exhibit this characteristic.

FAKE PRESS REPORTS ANENT RACKET INVESTIGATION

TREATING of the impending Senatorial investigation into racketeering, the New York *World-Telegram* recently front-paged a story having a Washington dateline in the course of which the affairs of Local 306 were given great prominence, the implication being that one of the first jobs of the investigation committee would be to inquire into the "rotten" conditions prevailing in Local 306 and other unions. Although investigation by INTERNATIONAL PROJECTIONIST tended to show that this story, despite its sensational handling by the *World-Telegram*, evidenced gross exaggeration, practically every motion picture trade paper promptly "lifted" the story and rewrote it for industry consumption.

So obvious is it that racketeering is conspicuous by its absence in the affairs of Local 306 today that the *World-Telegram*, which has used Local 306 for many a juicy story and shows great reluctance in letting the story die, has been forced to turn to the case of the permit men as a hub upon which to center its attack upon the 306 leadership. Forced to recognize judicial decisions favorable to both Local 306 and the I. A. in cases which it practically tried in its news and editorial columns, the *World-Telegram* has been hard-pressed to keep the Local 306 pot boiling.

Labor Not Singled Out

While it is true that labor unions will come under the eye of the investigating committee, it is also true that labor unions will get no more and no less attention than other groups and individuals. As a matter of fact, the biggest racket at the moment is that which has newspapers selling out to financial interests who control advertising expenditures. It is no secret around New York that powerful financial interests within and without the industry are out to "get" amusement unions; but it is not to be expected that the U. S. Government will lend a helping hand in these efforts. The harm in the *World-Telegram* story resulted when all the industry trade papers "lifted" the item and, without bothering to make even one phone call, promptly rewrote it and made a mess of what was already a built-up yarn. Possibly the industry trade papers would carry no news if daily newspapers were not published.—J. J. F.

What is the economical average amperage used in the various types of lamps?

Low Intensity Lamps 15 to 20 amperes
Hi-Lo Intensity Lamps 60 to 70
High Intensity Lamps 120 to 200

State Associations Prove Their Worth

N outstanding development of organization work during the past year is the demonstrated efficiency of state associations in matters of direct concern to a given state, as contrasted with the apparent inability of larger bodies—such as two, three, or more states—to get anything done. Invariably, the larger the group, the more scattered the territory, the more diverse the interests and the more pronounced the lack of coordination.

Particularly in legislative work was the worth of the state association demonstrated. While not always successful in carrying their objectives, state associations easily outclassed those units which, numbering among their ranks representatives of more than one state, found the load of conflicting interests much too tall an obstacle to hurdle. Effective state organization has often been the means for inaugurating policies which subsequently provide the basis for similar activity on a broader scale. The future development of state associations into highly useful cogs in the machine that is the International seems assured.—J. J. F.

FIG. 1

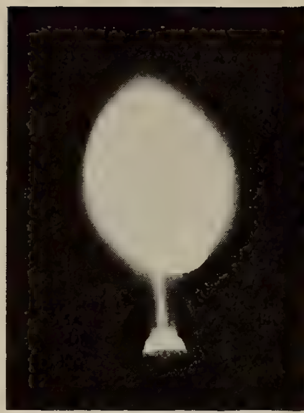

FIG. 2

FIG. 3

FIG. 4

Figures 1 through 3 illustrate the various types of carbon arcs now in common use. Fig. 4 shows the new A. C. projection arc.

NEW A. C. CARBON ARC OFFERS H. I. LIGHT

WHILE the present low-intensity direct current projection arc in general use by the majority of smaller houses, when viewed by itself, apparently gives a brilliant white light, nevertheless this light when compared directly with that obtained from the high-intensity arc is yellowish-white in color. The object of extensive research by National Carbon Co. that has brought about the development of a new alternating current projection arc, has been to bridge the present wide gap in effective screen illumination that exists between the high-intensity arc used by the larger theatres and the present low-intensity direct current arc. By this new development the smaller theatre may have the advantage of a snow-white light for screen illumination similar to that enjoyed by the larger theatres and which is so desirable for the satisfactory projection of colored films.

Not only has this marked improvement in color and brilliancy of light been accomplished by this new alternating current arc but it is also accompanied by other economical advantages. First, the power required to produce a given screen illumination with the new arc is less than that of the low-intensity direct current arc. Secondly, with the new alternating current arc, it is possible, by the use of a specially designed transformer, which is comparatively low in cost, to eliminate entirely the use of motor generator sets, rectifiers, converters, as well as the power-consuming ballast resistances now required with direct current projection equipment. This economy will appeal to all theatres located in districts where only alternating current is available.

Desirable Characteristics

The characteristics of this new alternating current arc are quite different from any other arc now in use. By means of special carbon design and control, it has been possible to effect an increase in arc current with a decreased arc voltage, thereby concentrating the light-giving power of the arc into a much smaller volume near the carbon tips than has heretofore been possible. This high concentration of power in such a small space allows the light to be focused easily by the means of a mirror, thereby making it a very desirable arc for projection. In reality, this new arc is a high-intensity alternating current arc. The color of light from this new arc is snow-white, and in operation it is very quiet and steady. Patent applications have been filed covering this new light system.

The accompanying illustrations, Figures 1 to 3, are photographs of the various projection arcs now in common use. Figure 1 shows the direct current high-intensity arc. The characteristic tail flame is noticeable in this illustration. Figure 2 is a photograph of the direct current low-intensity arc, and Figure 3 shows the old type low-intensity, white flame, alternating current arc.

Figure 4, which is an illustration of the new high-intensity alternating current arc, shows how radically different this new arc appears in contrast with the older type arc and how the light-giving power has been concentrated in a small space between the carbons. It is evident from this photograph why this new arc is so admirably suited to mirror arc projection.

A point of particular interest and one which is new to the projection field, is the use of the specially designed transformer as a source of

Table A

High-Intensity Reflecting Arc Carbons	Arc Current	Arc Volts	Average Line Watts: High Intensity A. C. Arc 95% Transformer Efficiency	SRA Carbons 35-Amp., 55 V. 80% Motor Generator Efficiency	Screen Lgt. Compared with SRA Carbons 35-Amp., 55 V.	Power Saved by A. C. High-Intensity Arc In Watts
6 mm.	40-45	22-25	945	3,500	60-70%	2,555
7 mm.	60-65	23-26	1,580	3,500	85-95%	1,920
8 mm.	70-80	24-29	2,130	3,500	115-150%	1,370

power for the arc. By this simple arrangement, it is possible to supply the higher current necessary for the operation of this new high-intensity alternating current arc at the right arc voltage with equal or even less line current than that drawn by the present low intensity arc equipment. The transformer used is a high-reactance, step-down transformer which automatically reduces the standard voltage supplied by the power company to the proper arc voltage and, at the same time, provides ballast and effects the necessary increase in amperage. The usefulness and economy of this method of transformation is evident when the efficiency of the transformer, 95 per cent and over, is compared with the 75 to 80 per cent efficiency of the best direct current converting equipment. As mentioned previously, further economy is accomplished due to the comparatively low cost of the transformer.

Types of Carbons Used

The carbons for the new high-intensity alternating current arc service, have been made in 6 mm., 7 mm., and 8 mm. diameters, the same size carbon to be used in each holder. The carbons are all metal coated to accommodate the higher current values necessary, which range from 40 to 80 amperes, or a current density of 800 to 1,000 amperes per square inch. The carbon consumption is as follows: 4 to 4.5 inches per hour for the 6 mm. carbons at 45 amperes—4.5 to 5.5 inches per hour for the 7 mm. carbons at 65 amperes and the 8 mm. carbons at 80 amperes.

Results of tests have shown that from the standpoint of uniformity of screen illumination, the new alternating current high-intensity arc is not only equal to the best low-intensity direct current arc, but has the very distinct advantage of the snow-white color resembling very closely that obtained from the direct current high-intensity arc. This marks a step forward in screen illumination, which will help greatly in improving projection in the smaller theatres. The improvement will be especially noticeable in the projection of colored films.

Table A will give a general idea of what may be expected from this new high-intensity alternating current arc in terms of well-known direct current projection systems. The 35-ampere, 55-volt super reflecting arc with the regular mirror arc optical system is chosen for this comparison. In arriving at the value for line watts, an efficiency of 80 per cent (unusually high), has been assumed for the motor generator sets in the case of the direct current arcs, and 95 per cent efficiency for the transformers used with the alternating current arcs.

Besides the other advantages previously mentioned concerning the uniformity, color and steadiness of this new arc, it can be seen from the above table that there is also an attractive saving in power costs. Projection equipment designed to use this new high intensity alternating current arc is well along in development.

[NOTE: In cooperation with National Carbon Company, INTERNATIONAL PROJECTIONIST will be glad to answer any questions relative to this new carbon arc development. The cooperation of readers is solicited.—*Editor.*]

METAL FILM COMPARED UNFAVORABLY WITH PRESENT STOCK

SAMPLES of metal film have been submitted by a reader of INTERNATIONAL PROJECTIONIST with the request that it be examined as to its worth for practical projection purposes as compared with the present film stock. The idea of metal film is not new, of course, several variations of such bases having been publicized from time to time during the past fifteen years.

Sponsors of metal film naturally emphasize the safety features of such stock. Admittedly, such film does minimize the danger of fire, but it certainly cannot be seriously considered as a substitute for nitrocellulose film unless it permits the maintenance of screen values and at the same time does not offer too many difficulties during projection. That metal film still is a dream so far as the motion picture field is concerned is indicated by the following report of a laboratory to which INTERNATIONAL PROJECTIONIST submitted the sample previously mentioned:

With regard to the sample of metal film submitted by you recently, we wish to make the following comments:

(1) The loss of light during projection would be almost prohibitive and, to make a rough guess, under any given conditions, the screen intensity would be only about 1/50 that existing when projecting by transmitted light with the usual motion picture film.

(2) If the metal film becomes buckled, it remains so more or less permanently.

(3) The edges of the perforations have no resiliency, so that they are much more readily distorted by the sprocket teeth than with nitrocellulose film.

(4) It is doubtful whether the degree of adhesion of the emulsion to the film would be satisfactory.

(5) It would appear to be extremely difficult to splice the film satisfactorily. The manufacturers have not suggested any method of splicing.

(6) With highly alkaline developers, it is probable that the aluminum would be attacked, and also, prolonged fixation in a fairly acid fixing bath containing silver salts would cause the deposition of silver which would tend to impair the high reflecting power of the aluminum surface.

AUTOMATIC DEVICES OFFERS NEW STABILARC, JR.

LOW-INTENSITY projection is expected to benefit materially through the introduction of the new Stabilarc, Jr., motor-generator. Heretofore, owners of smaller auditoriums have been handicapped by the necessity for using make-shift equipment for the conversion of A.C. into some form of D.C. for the projection arcs, such inferior equipment resulting in the production of pulsating current rather than a true uniform D.C. Sharply reduced illumination and pronounced flicker have resulted under such conditions.

The Stabilarc, Jr., motor-generator incorporates an entirely new design which removes the price differential heretofore existing between motor-generators and other cheaper forms of current conversion and at the same time offers to users of low-intensity projection true continuous D.C. (up to 30-amperes on each arc), of exactly the same high quality as enjoyed by the largest and best equipped houses. Manufacturer, Automatic Devices Co., Allentown, Penna.

After prolonged and intensive investigation into every phase of projection room operation and maintenance, the National Research Council, Canadian Government subsidiary, has completed its work and presented its findings, a complete exposition of which is offered herein. This report is fraught with tremendous significance to the art of projection in that it reflects the first serious attempt by an impartial and exceedingly well-informed group of men to provide the answer to the question as to what really constitutes efficient and safe projection room operation. The thanks of the entire projectionist craft are due those aggressive Canadian projectionist units which, through cooperative effort of a kind heretofore unknown within the craft, succeeded in focussing attention upon the importance of their work in the theatre and by so doing emphasized the importance of their members as craftsmen.—EDITOR.

PROJECTION ROOM REGULATIONS AND PRACTICES

THE REPORT OF THE NATIONAL RESEARCH COUNCIL OF CANADA

THE investigation covered by this report was undertaken at the request of the Prime Minister of British Columbia, as stated in a letter of August 4, 1932. A complete statement of the matter to be investigated was submitted by the Provincial Fire Marshal of British Columbia on October 14, 1932, in the following terms:

"Representations have been made to the Government of British Columbia by theatre owners, managers and others engaged in the motion picture industry, that the regulations now in force in this province requiring two licensed projectionists where two or more cinematograph machines are used in a theatre, are unnecessary and are placing too great a burden on the industry. Further, that the standards of examination for projectionists are too high and in excess of safety requirements.

"In support of the above it is stated that in view of the rigid requirements for the construction of the operating room and the up-to-date equipment used, that the employment of two licensed men is unnecessary, in that one man is thoroughly competent to do the work. They state, further, that under present regulations a heavy burden is placed upon them as they are forced to pay a high salary for work that could be well and safely done by one qualified projectionist.

"With reference to the question of examination, they submit that the standard is so high that competent men cannot pass, and as a result the operating field is now controlled by a few picked men who are able to demand exorbitant wages which the theatre owners are compelled to pay.

"As the administration of the Act governing the construction and operation of motion picture theatres is one of the duties of the Fire Marshal, I was asked by the Honorable Attorney-General, Minister of the Department, to report on the above with such comments and recommendations as I cared to make.

"Pursuant to this I made certain investigations and tests and submitted my findings to the Minister together with the recommendation that the whole matter be referred to the National Research Council, and that they be asked to make tests and submit their findings to the Government together with such recommendations as they feel will meet the requirements of public safety, having in mind the fact that a very large percentage of the patrons of our theatres are women and children."

. . . The need for the investigation arose out of the fact that certain features of the moving picture business are associated with fire hazards on account of the inflammable and explosive nature of the film, requiring special regulations with regard to the projection rooms and the consequent necessity for careful supervision during presentation.

Scope of Investigation

As the industry, in so far as it relates to sound pictures, is very new and in a state of development, the committee considered it necessary to get a true picture of the actual conditions by correspondence and by visits. Correspondence was entered into with the following: Dominion Fire Commissioner; Provincial Fire Marshals; International Fire Prevention Association; the technical experts of film manufacturing and equipment firms; manufacturers of safety devices; U. S. Bureau of Standards, Washington, D. C.; Fire Marshals active in fire prevention work; Fire Commissioners, Safety Councils, and Theatre Inspectors of a number of states and cities in the United States; insurance companies; Society of Motion Picture Engineers; the authors of more recent books on motion picture projection; the French National Research Laboratory; the British Home Office, the International Labor Office of the League of Nations. Written evidence was also submitted by the projectionists' unions and exhibitors' organizations. The more recent literature on motion pictures and safety devices was reviewed. In addition, theatres in Vancouver and Ottawa were visited to see machines in operation. Certain experimental work was also carried on.

In view of the technical nature of the investigation public hearings were not held. The investigation was conducted wholly from the point of view of public safety. A summary of the information gathered follows:

1. *Motion Picture Film and Its Products of Combustion*

Motion picture films now in common use consist of a light-sensitive layer (a suspension of silver compounds, or when developed of metallic silver, in gelatin) upon a support, one-tenth to two-tenths of a millimetre thick, of a special type of celluloid, consisting of about 15 parts of camphor and 85 parts of nitrocellulose. Nitrocellulose contains enough oxygen to support its own incomplete combustion, and when once the film is ignited, it continues to decompose and to pro-

INTERNATIONAL PROJECTIONIST is indebted to William P. Covert, second vice-president of the International Alliance, for his cooperation in making available for early publication the accompanying report of the National Research Council of Canada bearing on projection room regulations and practices.

duce heat and give off vapors, even in the absence of air.

The temperature at which a piece of motion picture film catches fire in the air is about 320 degrees F., according to the Du Pont Film Manufacturing Corp. The gaseous products of combustion vary widely in character according to the amount of oxygen readily available. In the absence of air, nitrocellulose film starts to decompose at a measurable rate at about 212 degrees F. The rate of decomposition increases rapidly as the temperature rises, several cubic feet of poisonous gases being produced per 100 feet of film. When these gases are mixed with a limited amount of air the mixture is explosive. There is, however, no danger of a serious explosion unless large quantities of film are being stored in a relatively small space.

In the regular course of operation, with approved types of machines, the picture remains exposed for only about one twenty-fifth of a second, and the degree of heating produced is well within the limits of safety, the temperature being far below that at which the decomposition of the film becomes measurable.

2. *Light Sources*

Light sources used for moving pictures consume from a few hundred to eight thousand watts each. Typical reflectors direct from 30 to 70 per cent of the available energy into the beam; lens systems about 5 to 20 per cent. Only a small amount of the radiation is absorbed in the film.

According to tests made by the Du Pont Corp., samples of stationary film left exposed in a projector fitted with 900-watt incandescent lamp were ignited in three to four seconds. The U. S. Bureau of Standards found that with carbon arcs ignition of film took place in from one-half to one second.

3. *Nature of Accidents Due to the Ignition of Nitrocellulose Film*

When a film takes fire in the projection room, the spread of the fire and the escape of fumes into the auditorium may alarm the audience and possibly cause a serious panic, even though the actual danger from fire or explosion be small. There is also the possibility of panic if the audience becomes aware through the image on the screen that the film has caught fire in the projector. As a rule, the only appreciable danger is to the projectionist, who may be burned or overcome by fumes in trying to extinguish a film fire.

4. *Cause of Fire*

A few projection room fires occur each year in Canada of such a nature as to completely interrupt the performances. The provinces of British Columbia, Alberta and Ontario combined, with 530 theatres, had 11 film fires in projection rooms during 1931, and five or six in 1932. (As a comparison, the city of New York, with about 550 theatres, had 22 such fires in 1931, and 24 in 1932.) Of 46 fires reported in Ontario as having occurred in projection rooms from 1929 to 1932, 29 were caused by the film breaking or stopping due to defective sprockets, poor patches, etc., two by failure of the fire shutter, three through defective equipment and one by poor lubrication of new film. In addition, 11 film fires were caused by carelessness; in six of these one projectionist and one apprentice were present, and in only one case two qualified projectionists. Of 24 fires reported from British Columbia for the years 1927 to 1932, inclusive, 14 were caused by the film breaking near the light aperture.

5. *Improvement of Machines and Films*

The dangers involved in the projection of motion pictures have long been recognized and steps have been taken to reduce them by improvements in machines and film, the adoption of fireproof construction and devices for smoke—control, and last but not least, *proper training of the projectionists.*

(a) Safety Devices on Projectors

In practically all machines, the film is protected by an automatic shutter which shields the film when it is not moving at the proper speed. While tests made show that it closes in ample time to prevent ignition of the film when the machine slows down, it is useless in the case of a film jamming or coming apart near a patch. For such an emergency a hand-operated shutter is provided. In addition, some machines have foot brakes. In order to prevent the fire from being carried into the magazines, metal rollers are placed near the points where the film leaves the upper, or enters the lower, magazine.

Experience shows that at the speed at which the film is moving these fire snuffers do not always stop a fire. The appearance of the image of the fire on the screen can often be prevented only by the quick action of the projectionist, who closes the hand shutter and interrupts the light.

(b) General Improvements in Projectors and Films

With the discarding of the separate sound record and the automatic adjustment of the proper sound level obtained from the film, the projection of sound motion pictures has been relieved of much of its burden. The additional risk involved in increasing the film speed from 60 to 90 per minute, in changing from silent to sound films, is largely offset by the necessity of discarding sound films while still in good mechanical condition. The use of more intense light sources is compensated at least in part by the introduction of rear shutters and by the shorter time each picture remains exposed to the light source during normal operation. It is impossible, however, to ignore the fact that with the high-intensity arc the film will ignite much sooner, in the event of stoppage. Moreover, the service engineers sent out by equipment manufacturers now inspect the projectors at frequent intervals. Decided improvement has also been made in the quality of the film.

(The trend undoubtedly is toward a more and more mechanical operation. By means of devices similar to those used for the reproduction of sound an automatic safety mechanism protecting the film from the light in case of accident might be developed. A safety film has been developed, but has not yet come into general commercial use.)

6. *Regulations Regards Projection Rooms and Machines*

(a) Fire-Fighting Equipment

Practically all persons in responsible positions consulted on this question consider the portable fire-fighting equipment ordinarily provided in projection rooms as of very limited usefulness for fighting film fires. Experiments carried out by the commit-

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Committee Personnel

The personnel of the committee formed by the National Research Council of Canada to inquire into and report upon projection room regulations and practices is:

H. M. Tory
President, National Research Council

F. C. Badgley
Director, Canadian Government Motion Picture Bureau

B. C. Ballard
Assistant Research Physicist

F. E. Lathe
Director, Division of Research Information, National Research Council

R. H. Manske
Associate Research Chemist

J. H. Parkin
Assistant Director, Division of Physics and Engineering

R. Ruedy
Research Investigator

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tee demonstrated this. The equipment is of value only in extinguishing fires arising from other causes.

(b) Construction of Projection rooms

In 1931, the Committee on Projection Room Practice of the S. M. P. E. formulated and recommended regulations concerning the construction of projection rooms. The Society is an organization with about 1,200 members—projection and sound engineers, manufacturers and managers of theatres. It is the recognized technical organization of the motion picture industry on this continent. In the same year at Toronto the National Fire Protection Association International approved the regulations set up by its own Committee on Storage and handling of motion picture films.

The sizes of the projection room called for by the regulations in British Columbia and Ontario conform completely with the largest dimensions recommended by the S. M. P. E. The fire-resistance of the room conforms to the standards set by the committees of the S. M. P. E. and the N. F. P. A. I. The regulations regarding port holes and shutters in British Columbia and Ontario agree closely with the best recommended practice. The regulations bearing on the ventilation of the projection room which are in force in the two provinces agree fairly closely with the practice recommended by the recognized authorities, except that a fan of sufficient capacity to remove all smoke and gas in case of fire is not unconditionally required.

It would appear, therefore, that as regards the projection room, British Columbia and Ontario regulations are in good agreement with the practice recommended by the committee of the S. M. P. E. and the N. F. P. A. I. In Manitoba the regulations are under revision.

7. *Present Practices Regarding the Number of Projectionists on Duty*

Ontario prescribes two projectionists where two machines are used in theatres, whether it be for silent or sound pictures. In British Columbia, Alberta, Saskatchewan and Ontario two projectionists are required when two sound picture projectors are operated during the same show, but in Saskatchewan and in the smaller theatres in Ontario one of them may have a license of a lower grade. British Columbia and Alberta insist that both projectionists for sound pictures possess the same minimum qualifications: first-class for the larger, and second-class for the smaller, theatres. In the other provinces, Manitoba, Quebec, New Brunswick and Nova Scotia, one projectionist is considered sufficient in any case.

Letters were sent out to fire marshals and safety councils in important centres in the United States. The replies received showed that practices varied widely even in towns of the same size.

Cities requiring the employment of two men are Washington, Detroit, Boston, Albany, Utica, and Newark. Philadelphia requires one operator, one assistant and an approved automatic safety device, in addition to the devices provided by the manufacturer. In Newark and Philadelphia the regulations have been in force for several years. Massachusetts and Connecticut have state regulations calling for two men.

In certain cities the unions have insisted that two projectionists be employed; in some others the managers have adhered to this practice as giving better service. Cities where two projectionists are employed as a rule, except perhaps in the smaller theatres, are New York (regardless of the number of machines installed); Pittsburgh, Rochester (one licensed operator and one apprentice); Cleveland (sound pictures); Grand Rapids, Indianapolis, the larger cities of Kansas and Salt Lake City. Cities in the northwestern part of the United States have theatres operating with one attendant.

8. *Regulations in Respect to the Technical Equipment of Projectionists*

In Nova Scotia, New Brunswick and Quebec only one type of projectionists' license is issued; in Saskatchewan there are two; in the other provinces three grades are distinguished, but the different grades are difficult to compare. Nova Scotia, New Brunswick, Quebec and Saskatchewan have oral and practical examination; the other provinces utilize written tests, with the exception of Prince Edward Island, which has no regulations.

Members of the committee familiarized themselves with the nature of the examinations, oral, written and practical, in British Columbia and Ontario.

9. *Operation of Motion Picture Projection Rooms*

Unannounced visits by members of the committee, who inspected several projection rooms in Ottawa and Vancouver during the regular performances, showed that with single-reel films it is usual to spend from two to four minutes out of eight, and with double-reel films, from three to five minutes out of sixteen, away from the projector in rewinding the film, cleaning the aperture, threading the new film and preparing the arc for the next run.

These visits also revealed the fact that many machines are equipped with revolving shutters in front of the machines instead of with rear shutters. In British Columbia rewinding was carried out in the projection room despite regulations barring this practice, and automatic rewinding machines were used without continuous inspection of the film.

10. *Conclusions*

1. That the safety of the theatre-going public and of the projectionist demands the continuous surveillance of every projector during the operation by a man of sufficient training and experience to enable him to operate the projector and all projection room safety devices with the utmost promptness in any emergency.

2. That the class of projectionist required to be in charge of any projection room should be decided according to the equipment of that room rather than the size of the theatre or the population of the town or city in which it is located.

3. That in projection rooms in which two machines are in operation and in which there is auxiliary equipment, such as effect machines, spot lights, etc., there should be on duty at all times during public performances at least two qualified projectionists. In the opinion of this Committee, it is advisable to use in this class of the-

(*Continued on page* 27)

LOCAL 306 WINS IMPORTANT CONTRACT CASE

A DECISION of great importance to Labor was handed down recently by the Appellate Court of New York, which ruled that contracts for union labor cannot be voided by the simple expedient of transferring ownership or control of a theatre. Pressed hard by Harry Sherman, 306 leader, this case undoubtedly will exert a profound influence on similar actions elsewhere, in and out of the amusement field.

The case involved Walter Reade, noted New York showman, who early in 1932 contracted with Local 306 for his Savoy Theatre at $350 weekly for the crew. In the midst of the Kaplan difficulties last December, Reade unsuccessfully sought a reduction. He then turned the theatre over to Rose-Reade, Inc., and informed Local 306 that his brother was the new owner. The latter promptly instituted an arbitrary wage cut for the crew.

Local 306 sued and won a judgment against the theatre for the difference in scale, following which the 306 men were supplanted by members of the Empire union. Local 306 asked in Supreme Court for an injunction against the discharge of its members. The application being denied, Local 306 appealed, its contentions being sustained by the Appellate Court as cited above, with theatre having to pay for time lost by 306 men.

Practically every union has experienced the effects of the "routine" which effects a "change of ownership" and thus voids contracts. Fake "closings" are of no avail against Local 306, since its contracts call for reemployment of 306 men when the theatre reopens.

SOUND ON STANDARD 16 MM. FILM

Dr. Lyman A. Wilson

RENAMEL RESEARCH LABORATORIES, NEW YORK CITY

FIGURE 1
Enlarged specimen variable area recording, on left

Efforts to record upon and reproduce from 16 mm. film sound of a satisfactory character continue unabated. Much of this development work is the result of a desire on the part of companies active in the 16 mm. field to expand the market for such equipment. The latest move in this direction is the plan to utilize major film company feature releases for exhibition on 16 mm. equipment in small towns where no motion pictures showings now occur. Details of this plan, together with a description of the equipment used, will appear herein next month. Apart from this latter consideration, the comparison between 35 mm. and 16 mm. sound-on-film technique and apparati should prove highly interesting to projectionists.—**Editor.**

IN any discussion on the topic "Sound on 16 mm. film" a question as to what is standard is frequently propounded. If one be actuated by a sincere motive in asking that question, the usual and obvious answer "Accepted practice" is quite sufficient. We find, however, in certain quarters a diversity of opinion on this all-absorbing modern topic. To delve into the past performances and ancient lore of the film industry and show by what laborious processes the present standards of motion picture film dimensions were arrived at is beyond the scope of this article

When the 16 mm. film was introduced we had at the time the 28 mm. non-flam which had come from Pathe in France, and another not so well known 17½ mm. film having its origin in this country. Proclamations from the lair of the 28 made it "Accepted practice" and it became "standard" in the non-theatrical non-inflammable field in spite of the advantages of the 17½, not the least of which was the lesser cost. The 28 has gone the way of all the flotsam of the early days of pioneering in the cinema art, although it deserved perhaps a better fate. The 16 mm. was ushered in and received with a welcome. Here was the film the world awaited. It was cheap. It was easy to handle and, above all, it would put a projector in every home.

It became standard. With the introduction of sound pictures, active minds began to speculate upon the possibility of having this, too, play its part through the loudspeaker.

About three years ago, Mr. Johnson, with whom the writer had been associated some years previously in motion picture enterprises and who in the meantime had become a 16 mm. enthusiast, suggested that we look into the matter of putting sound on the 16.

Investigations led us to the files of the patent office where we found not a few mechanical and optical arrangements, some purely dream combinations, and some based upon sound mechanical and optical knowledge. Undeterred by this array of previous effort, we set about to design and build a printer by which direct proportionate reduction of the 35 mm. film could be carried through to the 16 mm. A printer was built into which was incorporated a series of light stops and controls which function automatically and in unison when predesignated. This printer turns out excellent work; the picture is sharp and snappy and the sound-wave area of the track of the variable area recording is glass clear.

5,000 *Cycle Limit*

With the variable density recording the conditions may or may not be a little more difficult, depending upon the quality of the recording and processing of the original 35 mm. film. The results of this work have been satisfactory and it has been found possible to produce 16 mm. prints of the sound track with frequencies of from 60 to 6,000 cycles, provided the 35 mm. film represented a good recording job. It may be said frankly, however, that 5,000 cycles is the best that can be produced consistently and the work must be well done to do that. The picture and sound track on the film is a directly proportionate reduction of the 35 mm. and projection of the picture and reproduction of the sound does not entail problems that have not been solved in the 35 mm. field, and it is generally admitted that with the advent of sound, super-sensitive film and precise laboratory technic, screen results are superior to those of the silent days.

It is not intended nor is it likely that the 16 mm. film will intrude itself upon the 35 mm. domain, even though some film manufacturer give to the 16 mm. field a new, fine-grained emulsion film which it so richly deserves. It is to be understood, of course, that the above has reference to standard 16 mm. film with two rows of sprocket perforations with the picture and sound track between the two rows in the same relative position as is found in the 35 mm.

Fig. 1 shows an enlarged specimen of variable area recording. In this instance a negative was made from a 35 mm. positive, and the 16 mm. positive shown was made by contact printing from the negative. Fig. 2 shows a specimen of variable density recording made in the same way. It will be observed that both specimens express clarity and detail and are representative of average results obtained by the optical reduction method.

One Row of Sprockets

An effort is being made to have accepted as standard a 16 mm. film having picture and sound track with only one row of sprocket perforations. This principle harks back to the early days of the 16 mm. when manufacturers were striving to build cheap projectors to take the new cheap film. Cheap 16 mm. raw stock was imported having only one row of perforations for use in machines having a single-claw movement, and most machines of the early 20's were of that type. The single-claw machine and the film with a single row of perforations had little

but low production cost to recommend them, although they did serve a useful purpose in their time in projecting at low speed.

Before the advent of sound-on-film commercially, the silents were photographed and projected at 60 feet per minute, or 16 frames per second. With the coming of sound on the film it became necessary to step up the film speed in order that the higher sound frequencies might be clearly recorded. This step-up in the speeds of the camera and recording instruments also necessitated an equivalent speed increase of the projectors so that the photographic action and sound pitch would be normal. We find this speed to be 90 feet per minute, or a step-up of 50 per cent.

Action of Intermittent

With the Geneva movement type of intermittent the pin engages the slot in the star and twirls the sprocket a quarter turn, pulling down one frame. At a projection speed of 60 feet per minute it has been calculated that the pin strikes the star a blow of 85 pounds. This sudden shock is imparted to the film through the intermittent sprocket around which film is wrapped, one full frame engaging four perforations each side of the film, or eight perforations in all. Now, if we apply the formula that power requirements are the square of the speed, then the shock of the pin contacting the star must be tremendous at 90 feet per minute. Moreover, the speed of the film past the picture aperture requires a greater gate tension at 90 feet per minute than at 60 in order that the deceleration rate be sufficiently high to stop the film instantly, leaving the picture precisely centered in the aperture to prevent "jump" of the picture on the screen. This of course presupposes the intermittent to be in good order. No tension within the limit of the film can steady the picture and prevent "overshooting" or "undershooting" the aperture if the intermittent is "sloppy."

Now return to the 16 mm. film and see what may happen to the single perforation operated by a single claw intermittent under the higher speeds and gate tensions necessary in sound work. The 16 mm. film has 40 frames per foot, and when printed from an old 35 mm. negative it is projected at a speed of 16 frames per second or a linear speed of 24 feet per minute. If we have a sound track on the 16 mm. film, whether re-recorded or reduction-printed from the 35 mm., it must be projected at a speed equivalent to that from which it was made, which in this

FIGURE 2
Enlarged specimen variable density recording, on left

case is 24 frames per second, or a linear speed of 35 feet per minute, which is, as in the case of the 35 mm. film, a step-up in speed of 50 per cent.

Film Stress

Agreed that speed and power are synonymous and that speed is obtained at the expense of power, and if we again apply the formula of increasing the power with the square of the speed, we find all stresses on prime mover, gear teeth, bearings and all moving parts of the projector stepped up enormously. This can be provided for in the specification of suitable motor, metals or alloys from which the several parts shall be made; but what choice is there with regard to the film which must be subjected to the additional stresses incurred at the higher projection speeds? Surely it will not be contended that the film plays no part in it.

Consider what takes place when the claw enters the perforation at full speed on the pull-down stroke of the intermittent cycle. Under the impact of the claw a certain temporary deformation of the edge of the perforation occurs. The extent of the deformation depends, first, upon the load to be moved, which in this case is the static weight of the film plus the gate tension. Second, the speed at which it is desired to move the load; and third, the shape of the claw surface at the point where it contacts the edge of the perforation. We shall assume that we have plenty of power to drive the mechanism.

Analyze briefly the statements in the previous paragraph beginning with the assumption that we have a new film with commercially perfect perforations and a new projector in which the intermittent mechanism is of the single-claw type, film properly threaded and all set to go. The first downward thrust of the claw against the edge of the perforation will cause the temporary deformation mentioned, but due to the inherent flexibility of the film base, upon release of the claw pressure a return to original form takes place almost immediately. Continued repetition of this pull-down action induces fatigue or crystallization in the film base at the point of contact with the claw and the temporary deformation becomes permanent. The fatigue or crystallization is in reality a breaking up of the molecular cohesion in the acetate base at that particular point and it is quite generally known that the acetate base is not as tough as nitro base film. In other words, its molecular grip is not so tight.

Two-Claw Movement Preferred

The higher the gate tension, the greater the load and the higher the speed at which the load is to be moved, the quicker do the sprocket perforations tear out. It is believed that no single claw movement, however well made, can deliver adequate efficiency under the high speeds and gate tensions of present-day practice, regardless of how the pull-down or tension is applied. Film varies slightly in thickness even when new, and wear must take place along the sprocket tracks from the shoes or rollers, but the greatest wear is due to the inexorable pressure of the projection gate and the pull-down which must move the film under that pressure. If that pressure be applied to but one sprocket track rather than two, then that pressure must have sufficient deceleration or breaking effect to stop the picture precisely in the aperture if we are to have a steady picture on the screen.

The two-claw movement can be made to give maximum efficiency because the gate tension will be divided between the two sprocket tracks, and the pull-down force will be divided between two perforations parallel across the film and in line with the tension. Wear on the film will be more evenly distributed and the film life extended from 200 to 300 per cent.

There can be no valid objection to the use of a two-claw movement. It will cost more to build, but it is better. It demands better design and more accurate construction than the single claw. Any objection to the additional weight of the reciprocating parts as a cause of vibration may be dismissed by saying: "Build it light and right and let it run". Statements that the film perforations may not be parallel are not supported by investigations to date.

Details of Projector

Warpage and shrinkage in the film under certain conditions does occur and varies from ½ to 2½ per cent. This is a variable difficulty of control and must be accepted for the present.

Fig. 3 shows the laboratory model

of projector developed. The purpose has been to design a machine of rugged utility, simplicity, accessibility and freedom from minor repair tinkering. The film-moving element is of the two-claw type actuated by a triangular cam based upon the old Stevenson steam engine slide valve action, and if built right, is well adapted to this work. The shutter is geared to the intermittent shaft and is of the divided cylinder or barrel type and passes 55 to 60 per cent of the light. It intercepts the condenser beam close to the aperture and sets up a swirling air current with consequent cooling effect on the aperture plate.

Screen illumination is obtained by the use of a concentrated filament lamp of 7.5 amperes at 10 volts in a modified parabolic reflector having a supplemental reflector which picks up the divergent rays and passes them back to the main reflector. This method is highly efficient, and the filament being almost a point source of light, there is less heat and abberation than may be had with the bi-plane filaments and conventional condenser train. The projection lens is mounted eccentrically .030 in a sleeve to provide centering for full aperture with silent film when the aperture mask covering the sound track has been pulled back.

Sound Equipment

The projection lamp is slid forward for full aperture coverage, increasing the size of the light spot on the plate, and as there is no abberation in the beam, no other adjustments are needed. The projection gate may be thrown wide open for inspection and cleansing. The exciter lamp is of the same design as the projector lamp; the beam is projected through the light tube and adjustable diaphragm, at which the amount of light impinging upon the photo-cell may be varied at will according to desired amplitude to maximum. Experimental photo-cells have been made which show an unusually high light current output, and from data obtained in this work, it has been found possible to build cells which consistently give from 45 to 50 micro-amperes per lumen. This high cell output adds to the overall amplitude of the sound level and ground noise is in relation to that found in the 35 mm. prints recorded by either noiseless or fidelity processes.

Amplification is had through a two-stage p. e. c. amplifier with two 56 tubes mounted on the machine base, feeding through a 500-ohm line to a main amplifier of 46 tubes and dynamic speaker. Any amplifier of sufficient gain may be used, such as an electric phonograph or radio.

A four shaded pole, two-speed motor drives the machine at 24 feet or 36 feet per minute for either silent or sound films, either speed being preselected by throwing a switch mounted on the base of the machine. The film reel arms are swivel mounted so they may be folded over before placing the machine in the carrying case. The carrying case may also be used if desired as a blimp or sound-proof housing, with film reels outside. Film rewinding is done by the motor. Gears are of steel and bakelite composition and are pre-lubricated sufficiently for several months service. The machine chassis and gear housing are of cast aluminum and the complete assembly exclusive of main amplifier and speaker, weighs 42 pounds. It may be said that, in the writer's opinion at least, the 16 mm. standard film with two rows of sprocket perforations has sufficient surface area for a picture and sound track, each of ample proportions for satisfactory screen and sound work within the scope of its utility.

Size of Image

The picture image of the film may be screened as large as 6 x 8 feet, or even larger, depending upon the critical point of emulsion grain magnification and concentration of light and heat on the film at the aperture up to the char point of the film.

The facility with which a 35 mm. masterprint may be reduced to a 16 mm. negative and contact prints made therefrom, and the comparatively low cost at which this work may be done is of vital consideration, if the 16 mm. business is ever to come into its own.

The enlargement of the picture image size on the screen presents no greater problem than was presented in the 35 mm. field when the addition of the sound track required a reduction of the picture area on the film. It is merely a matter of ratios and the same practices which solved the problem in the 35 mm. field, apply equally well to the 16 mm.

High output photo-cells compensate for the decreased track width by giving stronger light current impulses in proportion to the amount of light striking the cell, consequently the p. e. c. amplifier passes a stronger modulated signal at reduced noise level to the main amplifier.

Continuous optical reduction of the sound track and picture from the 35 mm. film to 16 mm. is practicable if the reduction printer be built right and certain details observed, which impart sharpness and clarity to the track assuring frequency responses of from 60 to 5,000 cycles per second.

It is the writer's belief that as two rows of perforations are an integral part of the original design of the 16 mm., we should retain the old standard in all its integrity.

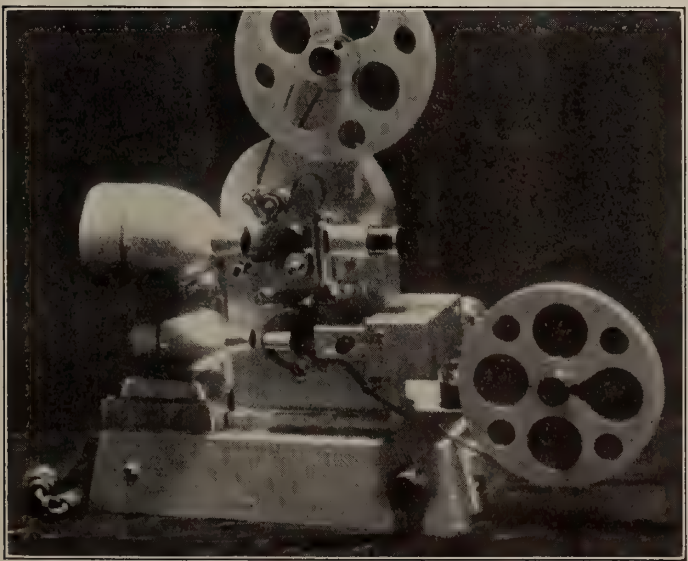

FIGURE 3

Laboratory model of 16 mm. projector

BETTER ORGANIZATION NEEDED, SAYS MRS. ROOSEVELT

In addressing a women's labor body recently, Mrs. Franklin D. Roosevelt cited the need for better employer-worker organization, as follows:

"I think that you could get better organization, which seems to be the thing that is needed, both in the laboring groups and in the employers' groups, because you have got to have organization on both sides to keep up the standards. You cannot, if you have a lot of people that are outside any kind of an organization, possibly keep up standards unless your public has a better conscience than your public, as a rule, has today. I think it has got to be a combination of better organization amongst the employers and better organization among the workers in order to keep up standards that are good.

"The public is suffering from the depression and for the first time, perhaps, is really willing to think on economic subjects—and, therefore, I think we have got a psychological time to arouse the public, such as we have never had before. I think if I were going after a practical program I would start out on the best publicity and advertising that could be gotten on the reason why it would benefit the public to see that their working people work under good conditions and then I would get every single women's organization interested from the humanitarian point of view and I would ram in all the economics I could. Every organization today knows the effect that working conditions are having on the community and families as a whole."

PERFORATIONS IN SOUND PICTURE SCREENS

Foreword: Attention has been directed of late to the sound picture screen as a very important link in the reproduction chain. Evidence is not lacking that the transmission of sound to a theatre audience involves something more than merely punching a given number of holes, evenly spaced, in a standard screen. Then, too, there are those who hold that neither perforated nor porous screens are essential to good sound reproduction, the conclusion reached by this group being that the horns should be positioned at either the top or sides of the screens and thus permit the use of a solid screen surface.

This latter topic is not discussed in the accompanying article, which was prepared by the Acoustic Department of Electrical Research Products Co. The article does establish, however, that the number of perforations, the frequency of the sound-wave and the character of the screen itself are inseparably linked, each of these items exerting a profound influence upon the transmitting qualities of a given screen. Table A included in this article reflects first publication anywhere of important transmission figures.—*Editor.*

TO THE audience in a motion picture theatre, the screen is the most apparent element in the projection of a picture. Before the introduction of sound, the screen's sole purpose was to serve as the source of visual stimuli. At present, however, its functions are two-fold as it must serve in an acoustic capacity as well. With loudspeakers behind it, the screen must now faithfully transmit to the audience the sound impulses accompanying a visual portrayal.

The characteristics of sound motion picture screens have been discussed by H. F. Hopkins in a paper appearing in the "Journal of the Society of Motion Picture Engineers" for September, 1930. He explained that a scre can transmit sound in three ways: by motion as a diaphragm, by direct passage of acoustic energy through perforation or pores in the material, and by wave motion within the material.

The last method is of comparatively minor importance and it turns out that most of the acoustic power originating on one side of the screen is transmitted to the audience by the first two methods. At low frequencies, diaphragm action induced by the acoustic power generated in the loudspeakers is the effective agency for the transfer of sound. In this case, the screen acts as a secondary radiator. At high frequencies, holes punched or woven into the screen are the effective means for the transmission of sound.

Effect of Perforations

In his paper, Mr. Hopkins discussed these factors in detail. Other work done since the time the paper was written substantiates his observations on the importance of perforations or holes in the screen. Some measurements made at Bell Telephone Laboratories are of interest in this connection. Tests were performed on a series of screens identical in all respects, save that the number of perforations was varied from zero to a condition whereby the perforated area comprised 9 per cent of the total screen surface. It was found that as the amount of perforation was increased, the reduction in acoustic power caused by the presence of the screen in front of the loudspeaker grew gradually less.

In other words, the screen became more acceptable as a link in the sound reproducing system with increasing amounts of perforation. As was expected, the influence of the perforations was most manifest at high frequencies. Table A shows the results of the measurements with the screen losses expressed in decibels.

The very real efficacy of perforations is shown by the table. At frequencies below 1,000 cycles, the improvement is slight; above this point, the contrast between the screen with no perforations and that with perforations corresponding to 9 per cent of the total surface is very marked. At 10,000 cycles, for example, there is a difference of 17.5 db.

From an optical viewpoint, of course, it is essential that the perforations be maintained at a minimum and that their size be small. Present types of screens represent satisfactory compromises between the optical and the acoustical requirements.

The thickness of the screen and the diameter of the perforations or other holes are also factors requiring consideration from an acoustical viewpoint. Acoustical theory—a detailed discussion of which is beyond the scope of the present treatment—indicates that the ratio of the thickness of the screen to the area of the individual openings should be small for efficient transmission of sound energy. In designing a screen, all these factors must be considered in order to produce a product that is commercially acceptable.

Table A

Frequency	Tranmission Loss—db			
Perforation:	0%	4.4%	6.8%	9%
55	.5	.5	.5	.0
100	.5	.5	.5	.0
200	.5	.5	.5	.0
500	.5	.5	.5	.0
1,000	3.0	.5	.3	.0
2,000	6.7	.7	.5	.5
4,000	11.0	2.0	.7	.8
6,000	14.5	3.0	1.0	1.2
8,000	18.0	4.5	2.3	2.0
10,000	20.5	6.0	3.8	3.0

Brevities

THE Essannay Electric Manufacturing Co., manufacturers of the Strong Change-over and other projection room accessories, is now established in new quarters at 823 South Wabash Ave., Chicago, Ill. L. D. Strong, president of Essannay, is a member of Local Union 110, I. A.

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Bizzelle & Company, Inc., with offices at 220 West 42nd St., New York, will handle all export sales for Pacent Engineering Corp., which recently purchased the principal assets of Pacent Reproducer Corp. and the Pacent Electric Co.

•

Reorganization of the Chicago Cinema Equipment Co. has been completed, the company to continue under the same name the manufacture and development of projection equipment, stage lighting equipment and other theatre accessories. Chicago Cinema has absorbed the Gallagher Orchestra Equipment Co. and will continue to serve the orchestra trade. Engineers of the company will be glad to consult with projectionists, managers and architects in the design of theatre equipment.

Officers of the company are: Walter Pitann, president; Alexander Berg,

vice-president; Arthur Pitann, secretary; Roy Bedore, sales manager; Milton Kanter, advertising, and Alexander Newman, chief engineer.

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Macy Engineering Co., manufacturers of public address equipment, is now supplying to the trade a catalogue of its products. Copies may be had upon request to the company at 1451 39th St., Brooklyn, N. Y.

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A booklet entitled "A Complete Reference on Photo-Electric Cells" has just been issued by General Scientific Corp., 4,829 South Kedzie Avenue, Chicago. The booklet catalogues full information about G. S. C. Lumotron products, such as prices, discounts, terms, etc. Another section offers information of a technical nature, including types of cells, dimensions, characteristics and applicability to various types of sound picture reproducers. Copies are available to projectionists.

For the Technical Library

MOTION PICTURE PROJECTION AND SOUND PICTURES, Fifth Edition, *by James R. Cameron and Messrs. Nadell, Rider and Dubray. Introduction by Dr. A. N. Goldsmith.* 1,535 *pages,* 700 *illustrations, including glossary and index. Published by Cameron Publishing Co., Woodmont, Conn. Price* $7.50. 5¾ *x* 8¾.

A monumental work, not only in size but for quality. Cameron has been writing motion picture technical books for eighteen years, but this, his latest work, is by far his best. This Cameron book is not about projection; it *is* projection.

The book starts at scratch, and between its covers is encompassed the entire subject of visual and sound projection. It really is four volumes in one, with four acknowledged experts each contributing a section on his own particular specialty. The book naturally is intended for projectionist consumption, but its real worth is indicated by the fact that a novice may read it and glean therefrom sufficient information to have a workable understanding of projection in 1933; while the experienced professional projectionist undoubtedly will enjoy a review of the fundamentals of the art before going on to the more advanced data.

The idea of utilizing co-authors, usually an experiment that just doesn't "pan out", has borne fruit in this instance. Projection is handled by Cameron himself; and then there is a great sound section by Aaron Nadell, whose work is well-known to and admired by many readers of these columns; there is an exposition of optics by Joseph Dubray that adds to the established reputation of this writer on the score of simple and lucid writing that makes for almost effortless reading; and last, but by no means least, there is a trouble-shooting section by John Rider which in itself is worth the price of the volume.

One searches in vain for phrases with which to do justice to this remarkable compendium on the art of projection: to have it and read it is to understand projection. Cameron deserves the thanks of the projection craft, and of everyone interested in the art, for this invaluable contribution to projection literature. All projectionists, novice or veteran, owe themselves the privilege of owning this volume. Beg, borrow or steal the price—but don't be without this latest Cameron book.

THE VISUAL FATIGUE OF MOTION PICTURES, *compiled and edited by Aaron Singer. A world-wide survey and summary on the effect of motion pictures on the eyes.* 48 *pages, indexed. Published by Amusement Age Publishing Co., 24 West 40th St., New York. Price* $1.00. 5 *x* 7¼.

Sailing uncharted literary seas, Mr. Singer has produced a unique and valuable volume. Infinitely more difficult than creative writing is the task essayed by this editor in ferreting out past and present opinion, together with a complete survey of the literature and a listing of research conclusions to date, relative to the effect of motion pictures on the eyes. That the completed work reflects a job well done is a tribute indeed to the persistence and ingenuity displayed by Mr. Singer.

While concerned in the main with what might be termed a by-product of projection, this little book provides a jolt to those complacent individuals who think they are well posted on projection. Even an experienced motion picture technician doesn't think very hard on the subject of visual fatigue resulting from viewing motion pictures, but this book proves that many minds in many lands—nearly every country in the world is represented by an opinion—are giving the subject serious thought, the net result of which processes cannot fail to profoundly affect future practice in the motion picture field.

The absence of opinions by practical projectionists does not alter the fact that this work is of intense practical significance. Any worker in the art, and projectionists in particular, will find in this book a fund of information that makes the purchase price insignificant indeed. It seems of great importance that as wide a distribution of this volume as is possible be obtained, so that succeeding editions, to be published each year, will become increasingly important and serve a mighty useful purpose. To Mr. Singer is due the thanks of the industry for an original idea.

THE PRINCIPLES OF OPTICS, *by Arthur C. Hardy and Fred H. Perrin.* 632 *pages,* 319 *illustrations; completely indexed. Published by Mc-Graw-Hill Book Co., New York. Price* $6.00. 6 *x* 9¼.

Adroitly side-stepping the dry-as-dust method of discussing optics, Messrs. Hardy and Perrin, faculty colleagues at Massachusetts Institute of Technology, have done a magnificent job in this presentation of data relative to pure and applied optics. It must be stated that the work is a trifle "heavy" for those who have not had a good early optical training, despite the expressed and apparent intent of the authors to stress the practical applications of the data offered.

For those who consider themselves well informed on the subject of optics this work is an indispensable necessity. To know the science of optics in 1933 one simply must have at hand the information spread upon the pages of this book. The keynote of the work is sounded in the preface: "Those who are accustomed to regard optics as an exercise in applied mathematics will be disappointed in the present treatment. . . . We trust that this lack of rigor is more than compensated by the greater emphasis . . . placed upon the principles themselves and upon the manner in which they can be applied". Thus the promise that is more than made good in succeeding pages.

W. E. AUDITORY PERSPECTIVE

To show the volume range possible with the new W. E. system of sound reproduction in auditory perspective, described in these columns last month, an orchestra played a selection at a constant level of loudness while the output of the loud speakers was varied from a level so low that the instruments could scarcely be heard, up to a loudness almost great enough to be painful. Throughout the whole range, the reproduction was faithful in all respects except the level of loudness; there was no distortion or noise to mar the perfection of the reproduction, and the wide range in volume was vividly impressed on the audience.

The effect of limiting the range in pitch, or frequency, was illustrated by employing electric filters to cut out one octave at a time—first from the upper end of the range and then from the lower. The new apparatus reproduces faithfully about 9 octaves or from 35 to 16,000 cycles, compared to about six for ordinary radio reproduction. By this demonstration the audience had the opportunity of judging the importance of the complete range to the full aesthetic appeal of music.

SOUND EQUIPMENT SERVICING BY PROJECTIONISTS

Aaron Nadell

IN A Middle Western city, a few years ago, a new theatre burned out a plate power transformer just a few hours prior to a much-advertised "Grand Opening." No duplicate transformer was to be found in that city, and the consensus, after considerable discussion, was that the opening would have to be postponed. The new theatre stood to lose about two thousand dollars in admissions and perhaps twenty thousand dollars in prestige. But, everyone said, there was no help for it.

Entered, at this point, a gentleman whose knowledge of sound apparatus was not as strong as his common sense. He asked:

"What does that transformer do?" The answer was: "It supplies high voltage a.c. to the rectifier." "All right," came the next question, "what does the rectifier do?" "Well, it changes that a.c. high voltage to d.c. high voltage and passes it on to the amplifier."

"And we can't work without the amplifier, is that right?" "That's right."

"And the amplifier can't work without high voltage, is that right?" "That's right, too."

"How much voltage does the amplifier need?" "Seven hundred and fifty."

"D. C.?" "D. C."

"Well, why don't we go out and buy seven hundred and fifty volts of B batteries to last till we get a new transformer?"

There was no reason why not. Fifty dollars' worth of B batteries were bought and a two-thousand-dollar show went on. It was an expensive emergency repair, but justified by the circumstances.

Repair or Replacement

There are two general methods of emergency action whenever it is not possible to do a proper repair immediately. One is to readjust or to modify the defective part or apparatus, to enable it to function temporarily. The other is to replace the defective part with something else, even something radically different, that will, by any round-about way, result in achieving the same fundamental purpose.

The case of the B batteries cited above is especially interesting because those batteries did not replace merely the damaged transformer but substituted for the entire rectifier, of which that transformer was only one part. Such broadly effective emergency treatment is impossible unless every part in the projection room is thought of in terms of *what it is there for* rather than in terms of what it looks like or of what work it performs in a more narrow and limited sense. A narrow and exact interpretation of the function of that power transformer would be that it existed to step-up the voltage of A. C. Only from the broader viewpoint that it was there to help supply high voltage *direct current* to the amplifier could the possibility of substituting B batteries for it become apparent.

The imagination and knowledge of the projectionist are in the last analysis the only limits to the possibility of emergency replacements. Imagination, of course, sometimes runs wild, and it is never desirable to undertake freak remedies until every normal possibility has been exhausted. And, of course, repairs of any kind are impossible until the nature and extent of the trouble have been accurately run down and are thoroughly understood. But when this has been done, and when it has been clearly shown that normal repair methods cannot be helpful for some time to come, then the ordinary repair man holds up the show and the better-than-ordinary man does something unusual.

The possibilities of unusual action are so great that it is almost impossible to exaggerate them. Consider any simple apparatus—a resistor, for example. What is its function? To limit the flow of current. What can be substituted for it? Almost anything. If the resistance is relatively low, a few arc carbons or even a glass of salt water may do. If the resistance is very high, running into megohms, a few pencil marks scratched on paper may serve. These are extreme suggestions. But any conductor in the projection room possesses resistance. Whatever conductors are available, including electric light and vacuum tube filaments, may be connected in parallel or in series or in series-parallel to secure the desired resistance and current-carrying capacity. (If filaments of any kind are used, remember that their resistance will change with heat. If they are to be used hot, determine their resistance by their rating; if they are to be used cold, determine it with an ohmmeter). But even this is an extreme suggestion, intended chiefly to emphasize the extreme possibilities.

In common practice such heroic steps will seldom be necessary. As a practical matter, resistors of any imaginable value can be found at the nearest radio repair shop, and the real problem is not obtaining a resistor but only finding out what value of resistance in ohms and current-carrying capacity in amperes is required.

Sources of Supply

Much the same is true of all other simple parts. In the case given above, the same radio store that furnished the B batteries could probably have supplied a suitable transformer, or transformers, that would have served admirably to replace the one that had burnt out. Yet even that would have been a practice to some degree extreme. The same radio store might also have been able to furnish an amplifier, complete with its own power supplies and with proper input and output impedances, that would have rented for much less than the cost of the B batteries.

While the possibilities of emergency methods are unlimited, their practical application should be drastically restricted to the easiest, quickest and simplest procedure—therefore to the one that will mean the least interference with the apparatus in the projection room, and to those methods which will come nearest to ap-

proximating the conditions of a neat and trouble-proof repair.

Another restriction is also important: the emergency repair should be one that requires the least disturbance in the position of wires and of other parts. In some cases, this restriction is vital: in dealing with filters, for example, displacement or lengthening of wires will in many cases result in the introduction of serious hum into the sound.

Again, it is always necessary to maintain at least approximate impedance match in speech circuits, for which reason it may occasionally be necessary, when emergency substitutions are made, to introduce added resistance in some form across a line that has been unbalanced by the attempted repair. (A headset furnishes a handy source of additional impedance. One receiver alone commonly has an impedance of about 1,000 ohms, giving 500 ohms for the two in parallel and 2,000 ohms for the two in series). The circuit drawing of the apparatus that has been disturbed by the attempted repair will give the best indication of the manner in which the impedance balance may have been upset, and the amount and circuit of the impedance needed to restore proper operating conditions.

Justifying Emergency Repairs

Last, but most important of all, any repair that reduces the resistance of a circuit may result in excessive current flow that will damage or destroy some other part of the apparatus. Any emergency step that involves possible reduction in the resistance of any circuit is dangerous unless adequate steps have been taken to insure that the attempted repair will not result in the creation of additional damage. In this connection it is important to remember that any inductive winding offers greater resistance to the passage of alternating current than to direct current and requires especial precaution against excessive flow of A. C. whenever any such winding is changed.

Because of these restrictions upon the freedom with which emergency methods can be applied such methods should, as far as possible, be worked out in advance, with the advice and help, where obtainable, of the manufacturer of the equipment. But before entering into that angle, it may be more advisable to inquire, at this point, when and under what circumstances emergency methods are to be used at all.

There are two sets of circumstances that justify application of well-advised but unusual emergency practices:

1. Whenever a serious trouble has been traced down as far as some one amplifier, rectifier, filter circuit or other limited portion of the equipment. Under such circumstances the show can be restored in two ways: by tracing further until the exact nature of the trouble within that amplifier, filter circuit or whatever it is has been run down and repaired in the customary manner. On the other hand, time and refunds may be saved if some rapid substitution can be made that will eliminate the guilty portion altogether, leaving more detailed investigation and more thorough repairs to wait until the end of the show.

Consider, for example, the case of that type of fader commonly used. Suppose the trouble has been traced to that fader. It may be opened up and the circuits traced until the exact trouble is found. On the other hand a double-pole, double-throw switch can be substituted for it, a pair of headphones connected across the switch blades to preserve a rough impedance match, and the show will go on, volume being controlled at the amplifier or by means of the exciting lamp rheostats.

2. Emergency repair methods are justified when a serious trouble has been definitely traced to some part (such as the plate power transformer mentioned above), for which no replacement can be secured within reasonable time. It is apparent, therefore, that the question of emergency repairs ties in very closely with the matter of maintaining on hand a suitable supply of spare parts, and that advance planning of emergency methods is useful not only to assure the success of such methods, when they are necessary, but has an additional value in governing the intelligent preparation of a list of those spares which must be kept available at all times. When repairs are carefully planned in advance of an emergency, the theatre's investment in spare parts can be economically limited to such equipment for which, as leisurely consideration shows, no practical or safe emergency substitute is easily available.

Advance planning for emergency procedure naturally involves two sets of plans, based upon the two classifications just given. In the first set will be contained a list of methods available for eliminating, temporarily, any portion of the equipment to which, but not *within* which, trouble may have been traced. Such plans are best drawn up with the help of a "block schematic" — the simple drawing, shown in Figure 1, described in an earlier article of this series. Consulting his schematic, the projectionist asks himself: "Now, what could be done, if *this* block went wrong?" The commonly used type of fader, mentioned above, would constitute one block of such a drawing. On the question of procedure in emergencies he may consult the manufacturer of his equipment or any source of advice available to him, and if he is not entirely satisfied with the steps he has planned for himself he may submit them for criticism to the manufacturer or to any other advisor. Or, if he is at least certain that they cannot do any serious harm—thoroughly certain—he may try them out for himself, after show time. Even those plans which have secured approval from competent advisors should be tried out, as a matter of rehearsal, to make sure they can be applied quickly and effectively amid the confusion of an emergency.

Replacement Requisites

In the second list of advance plans will be included methods of replacing any single part—power transformer, condenser, choke coil, resistor or what not—that is at all likely to cause trouble and for which no suitable substitute can be obtained immediately. This second list will be longer than the first, but when it is complete it can advantageously be compared with the list of spare parts kept on hand at all times, and the spare parts in-

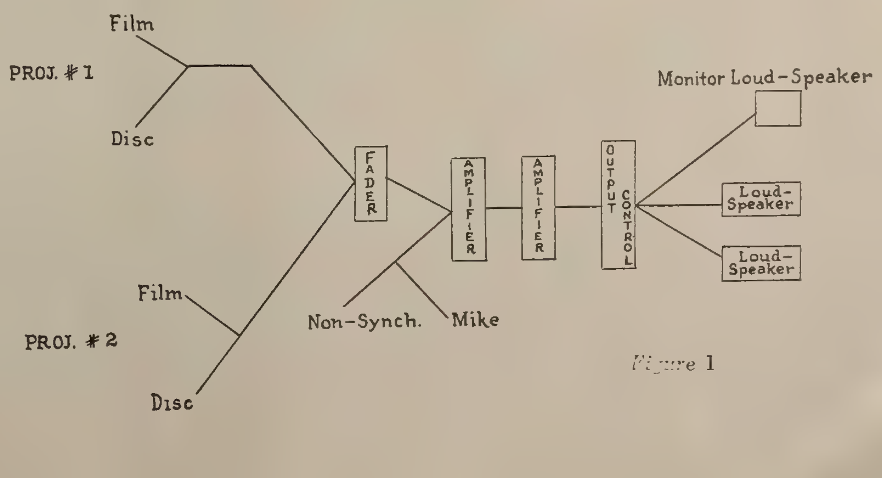

Figure 1

ventory reduced or enlarged as the comparison indicates to be desirable.

An important part of advance planning for emergencies will be a survey of the possibility of obtaining suitable replacement parts at radio stores, battery charging stations and other logical sources of supply within the community. How complete, from the point of view of the theatre's needs, is the local radio man's stock of supplies? How many storage batteries, should a power pack go dead, will the local charging station have available for renting? If the theatre operates on Sundays and holidays when such places are closed, can their owners be reached? How far away is the nearest stock room of the manufacturer of the equipment, and how long will it take to get parts from him? The availability of public address amplifiers that can, if necessary, take the place of the theatre's amplifying panel, and the proximity of a good machine shop that can help out in case of mechanical trouble are important factors in determining the emergency steps to be planned and the list of spare parts that must be carried.

Advance plans can never be complete. More things can happen to a sound system than anyone will ever be able to expect. There are two ways of making such plans as complete as possible. One is to list one's own experience with the same or similar equipment, adding to the list all other troubles of which the projectionist may have heard in discussions with other men operating similar apparatus. Another is to consult the manufacturer, who in most cases will have lists of troubles and their cures, based upon his servicing experiences or upon correspondence with his customers. The more complete the plans, the more efficient and economical will be the spare parts, and the smaller will be the liklihood of the projectionist being taken by surprise and failing to restore the show through some unexpected emergency.

Unplanned Emergency Methods

Unless planned in advance, unplanned emergency procedures will not be in order until after all normal methods of restoring the show have been exhausted. They are always dangerous. Carelessly applied, they may damage or destroy some other part. No emergency can justify applying any such repair methods without the clearest understanding of their exact effect upon all other circuits involved. It is better to let the show stay dead than to do further damage.

But when all considerations of caution have been exhausted, the fact remains that with a reasonably clear understanding of only elementary electrical theory, any prolonged interruption to the show is or ought to be very nearly impossible. It may be allowable to repeat: there is no limit to the possibility of emergency repairs except the knowledge and ingenuity of the projectionist.

That knowledge and ingenuity, however, must be applied within the limits of restrictions described in some detail above, which may be repeated merely as a list of precautions:

1. Prefer simple, quick, easy, unelaborate methods.
2. Prefer methods that will cause the least interference with other apparatus.
3. Prefer trouble-proof methods, neat and stable emergency connections.
4. Avoid displacing or lengthening wires when pick-up or hum may result therefrom.
5. Maintain approximate impedance match in speech circuits.
6. Above all, carefully maintain the resistance of a D. C. circuit and the impedance of an A. C. circuit, to avoid possibility of further damage resulting from an excessive flow of current.

Erpi Theatre Contract Held Illegal and Void

EXHIBITORS having equipment and service contracts with Electrical Research Products Co. (W. E. reproducers), do not have to buy replacement parts for these sets from Erpi, and producers need not recognize that clause in their recording contracts for W. E. equipment which states that they may sell the finished film only to those theatres which use W. E. reproducing equipment.

Such is the meaning of a decision handed down by Federal Judge John P. Nields sitting in Wilmington, Del.

The decision, which took the form of a grant of preliminary injunctions pending trial of the issues involved, refers to the suit of Stanley Theatres (Warner Bros. subsidiary); Duovac Radio Tube Corp., manufacturers of vacuum tubes, and General Talking Pictures Corp., sound equipment makers and distributors, against American Telephone and Telegraph Co., Western Electric Co. (95% control of which is held by A. T. & T.), and Electrical Research Products Co. (subsidiary of W. E.). The plaintiffs instituted the suit on the basis of the Clayton Act, relating to the lessening of competition and monopolistic practices.

5,000 *U. S. Theatres Affected*

More than 5,000 theatres in the United States having W. E. equipment are affected by the decision, although it should be remembered that only preliminary injunctions *pending trial* will be issued. The basis for the issuance of such injunctions had not been decided upon at this writing.

However, the decision does reflect the first serious break in the protective wall which Western Electric has built around its activities in the sound motion picture field. Heretofore it was accepted as inevitable that W. E.

(*Continued on page* 28)

Court Cases

THE trial of the action brought by more than 300 permit men of Local 306 against Harry Sherman, 306 president; William C. Elliott, I. A. president, and William Green, A. F. of L. head, charging unfair discrimination in the matter of privileges enjoyed, assessments paid and jobs allotted, has been concluded before Supreme Court Justice Riegelman in Brooklyn, N. Y. An early decision was promised by the Justice, with 306 leaders appearing confident of a verdict favorable to them.

Three receivers for Local 306 appointed last December by Supreme Court Justice Cotillo, of New York City, will get not a penny for their services, according to a decision handed down recently. Harry Sherman, president of Local 306, took the position that the action of Justice Cotillo in attempting to have a court operate a labor union, through receivers, was unwarranted and refused to pay the $15,000 fee demanded by the receivers. Decision mentioned probably means that it cost the receivers not a few dollars in personal funds to serve.

Ralph O'Hara, organizer for Local 110 of Chicago, was found not guilty of a charge of murder in connection with the shooting in Local 110 headquarters of Fred Oser, "opposition" union member. O'Hara admitted that he fired the shots that ended Oser's life, but insisted that his act was in self-defense.

Argument on the appeal of Sam Kaplan from Supreme Court Justice Miller's decision upholding the right of the I. A. General Executive Board in removing Kaplan as head of Local 306, will be heard before the October term of the N. Y. Appellate Division.

Review of FUNDAMENTALS OF SOUND

The probability that projectionists will shortly extend their activities to include the servicing of sound picture equipment has generated renewed interest in the fundamentals of sound recording and reproduction. Each month in this department will appear material which will serve this interest.

IT WAS explained previously that when a current is passed through a wire, a magnetic field is set up around it, and that a voltage is generated across a loop of wire placed in a magnetic field if the number of magnetic lines of force included within the loop are changed. The magnitude of the voltage generated depends upon the rate at which the number of lines of force through the loop are changed, i.e., if a change of ten lines of force per second produces a certain voltage, a change of twice ten, or twenty, lines per second produces twice the voltage. The total number of lines through the loop at the time of the change has no effect upon the voltage generated. Specifically stated, this means that the same voltage is produced in a coil when the number of lines is changed from 100 to 120 in one second, as when the number of lines is changed from 1,000 to 1,020 in one second, because the rate of change of the number of lines through the loop is the same (20 lines per second) in each case.

The direction of the generated voltage depends upon the direction of the lines of force through the loop, and upon whether the number of lines of force through the loop are increasing or decreasing.

The process of following through the different changes of position of a rotating loop so as to determine the nature of the generated voltage in it, is complicated and not easily understood. The generation of a voltage in a loop can be more readily understood if the sides of the loop are thought of as cutting the lines of force. When so considered the voltage generated is proportional to the number of lines of force cut per second, and the direction of the voltage generated depends upon the direction in which the sides of the loop cut the lines of force.

Figure 11 shows a magnetic field in which there is a loop of wire. The magnetic lines of force flow from the north pole to the south pole in parallel lines across the air gap between the poles. In (a) a loop of wire is shown in a position such that one side of the loop is cutting the lines of force in one direction, and the other side of the loop is cutting the lines in the other direction. The direction in which the loop is turning is shown by the arrow of the crank. Under this condition a voltage is generated in side "A" so as to cause current to flow in the direction shown by the arrow at that side of the loop. Side "B" of the loop cuts the lines of force in the opposite direction, therefore the voltage generated in side "B" causes a current to flow in the opposite direction, as shown by the arrow at that side of the loop.

The voltage generated in the sides of the loop causes a current to flow into one side and out of the other. In order for a current actually to flow through the loop, a connection would have to be made between the rings shown in the drawing. The drawings do not show an external connection, but the arrows indicate the direction the current would flow if an external connection was made. When the loop is in such a position as to be at right angles to the lines of force, as shown in (b), there will be no voltage generated in the loop, because the sides of the loop do not cut any lines of force when in this position. The same thing is true when the loop is rotated through a half turn, and side "B" is at the top and side "A" at the bottom. Therefore there is no voltage generated in the loop for two positions during each revolution.

When the loop is in the position shown in (c), one half turn from position (a), the voltage generated in side "B" is such as to cause the current to flow into that side of the loop, and the voltage generated in side "A" is such as to cause a current to flow out of that side of the loop. Thus the direction of flow of the current through the loop reverses as it changes its position from (a) to (c). When the sides of the loop are in the positions shown in (a) and (c), the number of lines of force cut for a given amount of rotation is greater than when the loop is in any other position.

As the loop rotates from position (a) to position (b) the number of lines cut for equal amounts of rotation gradually becomes less until, at position (b), no voltage is generated, because when the loop is in position (b), the sides of the loop are moving along the lines of force instead of cutting them. From this it is seen that the voltage is continuously varying in magnitude and twice during each revolution the voltage is zero; also, the voltage changes direction twice for each revolution.

The current generated by such a machine is called an alternating current because it alternately flows in one direction and then in the other. Two rings, one connected to each side of the loop, are provided, together with wiping contacts called "brushes" to permit external connections to the loop while it is in rotation. The rings are called "collector rings," or "slip rings." These rings are usually made of copper or brass, but iron is sometimes used. They are insulated from the shaft and from each other. The brushes are usually made of carbon or a combination of carbon and some metal.

A DC generator is the same as an AC generator except in the manner of collecting the generated current. Figure 12 shows a simple DC generator consisting of a magnetic field, one loop, and a collector ring split into two parts. These parts, called "segments," are insulated from the shaft and from each other. One segment is connected to one end and the second segment to the other end of the

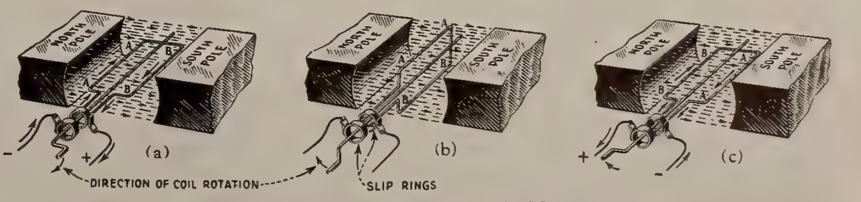

Figure 11—Showing operation of AC generator

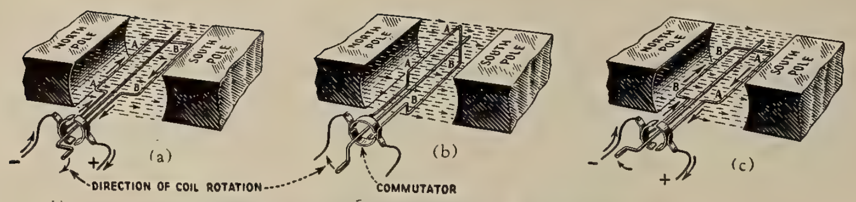

Figure 12—Showing operation of DC generator

loop. This type of collector is called a "commutator."

As in the case of an AC generator, brushes are mounted so as to make a wiping contact with the split ring and permit current to be drawn from the generator as it rotates. The brushes are mounted so that they change contact from one segment to the other when the loop is at right angles to the lines of force as shown in (b) of Figure 12. It will be remembered from the discussion of the alternating current generator that, when the loop is in this position, there is no current generated in it. Therefore, shorting of the loop, caused by the brushes making contact with both segments at the same time, will do no damage because there will be no current flowing.

When the loop is in the position shown in (a), the current will flow in at the left-hand brush and out at the right-hand brush. When the loop is in position (b) no current will flow because no voltage is generated in the loop. When the loop is in position (c) the current again flows in at the left-hand brush and out at the right-hand brush. The current that flows in the loop changes in direction as the loop changes from position (a) to position (c) as it did in the AC generator, but the brush connections also change when the loop is rotated, that is, side "A" of the loop is connected through the commutator to the left-hand brush when the loop is in position (a), and is connected to the right-hand brush when the loop is in position (c), so that the net result is that the current always flows in at the left-hand brush and out at the right-hand brush.

The current flowing in the load circuit of such an arrangement just described, with only one loop and two segments, is pulsating (continually varying in magnitude), but flowing always in the same direction. In practice, a large number of loops and segments are used so as to give a fairly constant DC voltage. The loops are connected in series in such a way that the generated voltage is the sum of the voltage generated in nearly all of the loops. The brushes are of such size as to short-circuit two or three of the segments, which short-circuits two or three loops. These loops occupy a position as shown in (b) of Figure 12 when they are short-circuited, and very little, if any, voltage is generated in them. However, the current through the loops must change in direction as they pass under the brushes, and an arc will form at the brushes unless they make a firm, even contact. For this reason it is important that the brushes fit the commutator snugly, and that the commutator is kept clean.

THE operation of a motor is the same as that of a generator except that the current of a motor flows in the opposite direction through the machine from that in which it flows when the machine runs as a generator; that is, the current flows in one direction with respect to the generated voltage in a generator, and in the opposite direction with respect to the generated voltage in a motor. The current flows into the motor through the positive brush and out at the negative brush. The current of a generator flows out of the positive brush and in at the negative brush. The reason for this is the fact that the generated voltage of a motor is always in opposition to the applied voltage, but never quite as great. Therefore, the applied voltage forces a current through the motor against the electrical pressure offered by the generated voltage.

When a current is passed through the armature winding of a motor, a magnetic field is created in it which has a north and south pole. These poles are attracted by one pole of the motor field and repelled by the other, causing the armature to rotate. In the case of an alternating current machine the field rotates according to the frequency of the alternating current, and the windings follow this field around.

In the case of a DC machine, as the winding rotates the commutator rotates, and the windings through which the current flows is continually changing. The magnetic poles of the revolving windings are always kept at a fixed angle with respect to the field poles and a steady rotating force is maintained. As each portion of the armature winding reaches a postion where the field poles produce no turning effect, the commutator action is such as to disconnect these coils, and to connect others which are in a position where a turning effect may be had.

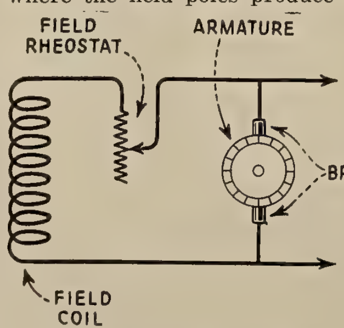

Figure 13—Field control of DC motors and generators

Commercial Motors and Generators

Motors and generators, as they are built for use, do not look anything like the illustrations shown in Figures 11 and 12. These illustrations show the action of the machines, but the machines themselves are built in a considerably different form. The field poles of a commercial machine are not "permanent" magnets, but are "electro-magnets" consisting of a field-winding on an iron core. The current for the field-winding is supplied from some source of direct current. In the case of a DC generator, this current is usually supplied by the generator itself, and in the case of the DC motor the field current is supplied from the same source as the current that runs the motor. AC motors are more complicated in their action although the same principles are involved. The explanation of the process is very involved and will not be taken up here.

Figures 11 and 12, show a loop rotating in a magnetic field. In practice a large number of loops are used and they are mounted on an iron core. This iron core reduces the length of the magnetic field in air, and therefore makes it easier to create a strong magnetic field. The space between the rotating iron core carrying the rotating windings and the poles is called the air gap. This air gap varies with the design and size of the motors. For small machines it is sometimes only a few thousands of an inch, while for large generators the air gap may be several inches wide. The rotating part of motors and generators is called the "rotor." In all DC machines and in some AC machines, it is often called the "armature" of the motor or generator. Strictly speaking, the armature is that part of the machine wherein the magnetic field rotates with respect to the windings.

Voltage Control of Generators

As stated earlier in this article, the voltage generated in a conductor which is moved through a magnetic field depends upon the number of lines of force cut by the conductor in a second of time. Therefore, if the speed with which the conductor cuts the lines of force is increased, the voltage gener-

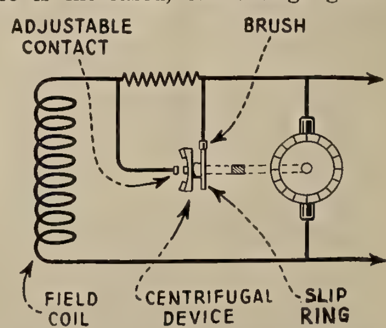

Figure 14—Wiring diagram illustrating operation of speed control device

ated will be increased. There are two ways of increasing the number of lines of force cut per second by a conductor: one is to speed up the movement of the conductor, and the other is to increase the number of lines of force.

The speed of generators is usually constant, and the voltage is regulated by changing the field strength (increasing or decreasing the number of lines of force in the field). The field strength is controlled by the current in the field winding, and this current is controlled by putting resistance in series with the field winding. See Figure 13. This resistance is made variable, and the device for changing the resistance is called a "rheostat." When resistance is "cut out" of the field circuit, the current increases so that that number of lines of force are increased, and the generated voltage increases in proportion to the increase of the magnetic lines of force of the field. The voltage of a generator is decreased by increasing the resistance in the field circuit, and thereby decreasing the field current.

DC Motor Speed Control

While a DC motor is rotating, it generates a voltage in the same way that a voltage is generated in a DC generator. The generated voltage is in the opposite direction as the applied (line) voltage, but not quite equal to it. The voltage which causes a flow of current through a motor is the voltage difference between the line voltage and the generated voltage of the motor. If the line voltage is 110 volts and the generated voltage of the motor is 105 volts, the difference of voltage (110-105, or 5 volts) is used in causing a current to flow in the motor. The resistance of a motor is rather low, and, as a result, a fairly large value of current will flow through the motor armature for a slight difference of voltage between the line voltage and generated voltage of the motor.

The generated voltage of a motor, like the voltage of a generator, depends upon the speed of the motor and the number of lines of force in the field poles. The speed of the motor automatically regulates itself so that the generated voltage will allow just enough current to flow through it to produce the necessary torque (turning power) to keep the motor running. If a braking force is applied to the motor, it will slow down a little so as to allow more current to flow to increase the torque. If the number of lines of force in the field of the motor is increased, the motor does not need to run at as high a speed to produce the necessary generated voltage, and the motor slows down. If the number of lines of force in the motor field is decreased, the motor must speed up to produce the necessary generated voltage. Therefore, if a rheostat such as described for regulating the voltage of a DC generator is used in the field

circuit of a motor, the motor can be made to "speed up," or "slow down," by changing the amount of resistance in the field circuit. See Figure 13. When the resistance of a motor field circuit is decreased, the motor "slows down" and if the resistance is increased, the motor will "speed up." Therefore, the use of a variable resistance in the field circuit is a very practical method of controlling the speed of a DC motor.

Ratings

Motors are rated in horsepower (hp.) or kilowatts (kw.). One horsepower is equal to approximately three-quarters of a kilowatt.

A kilowatt is a thousand watts, and a watt is a unit of electric power. The number of watts of power in a DC electric circuit, or in an AC circuit of pure resistance, is equal to the product of the voltage across the circuit and the amperes through the circuit.

DC generators are usually rated in kilowatts.

AC generators and converters are usually rated in kilovolt-amperes (kv-a). The kv-a of a circuit is the product of the volts and amperes divided by 1,000. For example: An AC machine that will deliver 20 amperes at 440 volts has a rating of 20 multiplied by 440 and divided by 1,000, or 8.8 kv-a. In DC circuits or in AC circuits of pure resistance the KV-a. and kw. are the same, but in some AC circuits this condition does not hold, and the product of the voltage and current is not equal to the watts of power delivered to, or taken from, the circuit. In all such cases, the product of volts and amperes is always greater than the watts of power. The reason for this is very complicated and will not be taken up here.

Heat is Limiting Factor

Usually motors and converting equipment are rated also in volts and in amperes. The rating in amperes should never be exceeded, even though the machine may not be delivering its rating in horse-power or kilowatts, because the heating (which is the limiting factor) depends upon the current through the machine.

(To be continued)

RECTOX BATTERY CHARGERS

The Rectox Battery Charger is completely described and illustrated in a recent four-page publication issued by the Westinghouse Elec. and Mfg. Co. The construction, application, and operation of the charger are explained in the leaflet pointing out the distinctive features and advantages of this type of dry, non-chemical, metallic oxide rectifier. Copies of the leaflet may be obtained from the nearest district office or direct from the company at East Pittsburgh, Penna.

PROJECTION ROOM PRACTICES AND REGULATIONS

(*Continued from page* 14)

atre only men of the highest qualifications.

4. That in projection rooms in which two machines are in operation without the auxiliary equipment such as mentioned in the foregoing, there should be on duty at all times during public performances at least one qualified projectionist and an assistant projectionist.

5. That in projection rooms in which there is one machine only in operation, there should be on duty at all times during public performances, at least one qualified projectionist.

6. That a qualified projectionist be defined as one possessing minimum qualifications corresponding to those required for Grade B License in Ontario or a second-class license in British Columbia, or their equivalent.

7. That an assistant projectionist be defined as one possessing minimum qualifications corresponding to a Grade C license in Ontario or a third-class license in British Columbia, or their equivalent.

8. That in British Columbia and Ontario, the examinations as at present conducted appear to be adequate and do not make excessive demands, considering the responsibilities to be assumed.

Equipment and Rewinding

9. That in all projection machines the revolving shutter should be located between the light source and the film.

10. That arrangements for rewinding should conform to the present recommendations of the S. M. P. E.

11. That rewinding should be done by hand; automatic rewinding should be prohibited.

12. That, as the regulations governing the construction of the projection room in Ontario and British Columbia are found to be in reasonable agreement with the recommendations of the S. M. P. E. they are considered as satisfactory by the Committee.

13. That in order to reduce to a minimum the danger of panic and to provide for the safety of the operators, provision should, as far as possible, be made for the operation of ventilating fans, electrical equipment and safety devices from the outside as well as the inside of projection rooms.

14. That it would be to the advantage of all the provinces of Canada if common regulations could be adopted. It is suggested that a representative committee be appointed by the provinces to draft standard regulations that might be acceptable to all the provinces. The National Research Council would be glad to co-operate in any way possible to that end.

Erpi Theatre Contract Held Illegal

(*Continued from page 22*)

could dictate to both its exhibitor and producer licensees the terms under which the W. E. equipment, or the product thereof, might be used. In effect the ruling decrees an open market for all replacement parts, whether or not they are to be used with W. E. equipment.

Although Erpi denies that the decision in any way affects the servicing situation, well-informed opinion in the trade is confident that the issue of compulsory servicing is next in line for judicial determination. The decision, in part, follows:

Motions for preliminary injunctions are made on behalf of plaintiffs in three equity suits brought under section 16 of the Clayton act to restrain defendants from alleged violations of section 3 of that act and of sections 1 and 2 of the Sherman act.

In their main briefs plaintiffs state the measure of relief sought by these motions for preliminary injunctions. "It is therefore submitted that an injunction pendente lite should issue herein in all three cases enjoining and restraining the defendants from enforcing directly or indirectly the restrictive clauses of the so-called leases of reproducing equipments, whereby the exhibitors are required to obtain exclusively from Products (Electrical Research Products, Inc.) all repair and replacement parts for said equipments and to permit Products to inspect the same and charge the Exhibitor therefor, under the guise of rendering service thereto. In addition, in the suit of the Duovac Company, an injunction should issue pendente lite enjoining and restraining the defendants from directly or indirectly enforcing any of the provisions of the producing license agreements whereby the producing licensees of Products are required to obtain exclusively from Products repair and replacement parts for reproducing apparatus."

Competitive Angle Stressed

The motions deal with covenants in agreements the effect of which may be to substantially lessen competition in interstate commerce in the talking motion picture business. Roughly, that business is handled by the manufacturers, the producers and the exhibitors. The *manufacturers* make the recording equipment for the producers of films. This equipment records sound and photographs action in timed relation on the films. The manufacturers also make reproducing equipment meant for the exhibitors. This equipment synchronously reproduces the sound and projects the action on the theatre screens. The *producers* use the recording equipment in producing the films. The *exhibitors* use the reproducing equipment in the theatres.

The plaintiff, Stanley Company of America, Inc. (Delaware), is a subsidiary of Warner Brothers. It is an exhibitor, owning a chain of about 150 theatres. The plaintiff, Duovac Radio Corp. (Delaware), is engaged in the manufacture of electrical devices, including vacuum tube amplifiers and photo electric cells. The plaintiff, General Talking Pictures Corporation Delaware) is a manufacturer of talking motion picture equipment.

In each case the defendants are the

same. Western Electric Company, Inc., is a manufacturer as above defined. American Telephone and Telegraph Company is a defendant holding 95% of the capital stock of Western. Electrical Research Products, Inc., herein called "Products," supplements the business of Western by licensing under patents and leasing producing and reproducing equipment and also furnishing services relating to the upkeep of the equipment.

Clayton Act Applies

Section 3 of the Clayton Act provides:

"It shall be unlawful for any person engaged in commerce, in the course of such commerce, to lease or make a sale or contract for sale of goods, wares, merchandise, machinery, supplies or other commodities, whether patented or unpatented, for use, consumption or resale within the United States or any territory thereof or the District of Columbia or any insular possession or other place under the jurisdiction of the United States, or fix a price charged therefor, or discount from, or rebate upon, such price, on the condition, agreement or understanding that the lessee or purchaser thereof shall not use or deal in the goods, wares, machinery, merchandise, supplies or other commodities of a competitor or competitors of the lessor or seller, where the effect of such lease, sale, or contract for sale or such condition, agreement or understanding may be to substantially lessen competition or tend to create a monopoly in any line of commerce."

An examination of the numerous affidavits and voluminous exhibits filed on this motion shows that certain restrictive agreements contained in the licenses or leases made by Products are inherently illegal,—the import of which could not be changed by testimony. These restrictive agreements are: (1) The Tying Agreements in the licenses or leases of Products to exhibitors, whereby exhibitors agree to purchase from Products all repair and replacement parts for the reproducing apparatus and equipment leased by Products. (2) The Exclusive Agreements in the contractual letters accompanying the leases of Products to producers whereby producers agree to distribute films produced on the producing apparatus only to exhibitors supplied with Products' reproducing apparatus and equipment.

Replacement Demand Illegal

The Tying Agreements on the part of exhibitors to purchase repair and replacement parts from Products are found in all the licenses or leases made by Products of reproducing apparatus or equipment to exhibitors. For example, in the license or lease dated July 29, 1931, from Products to Stanley Company of America (Plaintiffs' Exhibit Vol. III, Exhibit-J) we find the following agreements. Section 2 (b) " * * * * it is agreed that all additional and renewal parts and assembled parts for the Equipment shall be obtained from Products and that all repairs to the Equipment shall be made as specified by Products. Products may from time to time at the expense of the Exhibitor, supply and install such spare and renewal parts as may, in its opinion, be necessary to the satisfactory operation and maintenance of the Equipment."

These tying agreements found in the licenses or leases of reproducing apparatus and equipment made by Products to exhibitors are rendered more effective and burdensome by additional sections of the Licenses:

Section 7—"The Exhibitor agrees to pay to Products upon rendition of invoices therefore its standard charges as from time to time established for any repairs to the equipment and for any additional equipment or spare or renewal parts, furnished or supplied by Products and to pay the transportation charges thereon. * * * "

Servicing Facilities

Section 11—"The Exhibitor shall provide access for Products' representatives, engineers and mechanics to the Theatre and to all parts thereof where any of the Equipment may be, at all reasonable hours, for the purpose of supervising the installation and

from time to time for the purpose of examining and inspecting the Equipment, and shall grant to Products full opportunity to make such adjustments therein and repairs thereto as, in the opinion of Products, are necessary or desirable."

Section 13—"This agreement and/or the rights of the Exhibitor hereunder and/or the license hereby granted shall, at the option of Products, terminate and come to an end in the event of any breach or default on the part of the Exhibitor with respect to any of the covenants and conditions herein contained on its part to be performed, * * *."

Section 14—"Upon termination or expiration of this license by lapse of time or otherwise, the Exhibitor shall surrender the Equipment to Products in good order and conditions, * * *."

Section 18—"This license shall be for a term of ten (10) years from September 22, 1928."

Section 22—" * * * Exhibitor agrees to pay to Products the charges provided for in the payment plan hereinafter set forth; said payments to be made at the time and in the manner provided herein, which time and manner shall be of the essence of this agreement."

(1) $17,192.43 (2) A "weekly rental charge" of $40.00 per week.

The exclusive agreements in the contractual letters accompanying licenses from Products to producers is illustrated in the contractual letter of Products to Paramount Famous Lasky Corporation dated May 11, 1928 (Plaintiffs' Exhibit—18). Paragraph 5 of this contractual letter provides as follows:

"5. In order to promote the use of sound records in connection with motion pictures, and to make an adequate market for your productions and for our (Products') reproducing equipment, you agree that all theatres operated by you or by your associated companies shall install our reproducing equipments (which you agree are hereby adopted as the standard equipment for such purposes), wherever and as rapidly as in your judgment conditions permit, and we will supply such equipments as rapidly as we are able to after receipt of orders therefor * * *."

Similar exclusive agreements are in the contractual letters of Products to other producers and are indorsed "Accepted" by the producers. These letters accompany the licenses (Recording License Agreements) of producing apparatus and equipment of Products to the producers. The licenses are for 16 years.

The exclusive agreements in the contractual letters require producers to refrain from distributing the talking motion pictures to theatres and exhibitors who have not acquired reproducing equipment from Products. As the result of these exclusive agreements the supply of talking motion pictures would be substantially closed to exhibitors who did not install reproducing apparatus and equipment purchased from Products. These exclusive agreements are bound to restrain exhibitors from using or dealing in goods, wares, merchandise, machinery, supplies or other commodities of a competitor or competitors of Products.

I find from the proof submitted in support of the motions for preliminary injunctions that the tying agreements contained in the licenses of reproducing equipments by Products to exhibitors and the exclusive agreements in the contractual letters of Products to producers, in fact, have substantially lessened competition in interstate commerce and will so continue unless defendants are restrained.

Agreement Held Illegal

"Today," says Dean Pound, "we seek once more, by limiting freedom of contract, to protect those who are subjected to economic pressure against unfair advantage on the part of those who have greater economic freedom." The Clayton Act expresses this modern trend in legislation. Section 3 of the act prohibits tying agreements and exclusive agreements whose effect may be to substantially lessen competition. Such agreements are contained in the licenses of reproducing equipments by Products to exhibitors and in the contractual letters of Products to producers. *I hold those agreements illegal and void.* United Shoe Mach. Co. v. United States, 258 U. S. 451. Lord V. Radio Corporation of America, 24 F. (2d) 565; affirmed 28 F. (2d) 257 (C. C. A. 3). I have not listed the particular licenses and contractual letters of Products containing the illegal agreements dealt with in this opinion because they are numerous and substantially alike. The decrees for preliminary injunctions may be so drawn as to cover them.

(Sgd.) John P. Nields.

June 28, 1933. J.

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MONTHLY CHAT

INTERNATIONAL PROJECTIONIST recently had occasion to investigate the much-discussed topic of occupational hazards of projection work. The report of this snooping has not yet been completed, but the outline promises many a surprise to those projectionists who never give a thought to their physical condition until they are threatened with a complete breakdown. Projectionists are notorious for irregular living—their sleeping and eating being on as disorganized a schedule as one could imagine—and this is but one factor which exerts a strong influence on their well-being, or lack of it.

First-hand information on this subject as soon as possible—probably in our next issue.

SO-CALLED automatic change-overs are discussed in the report of the S. M. P. E. Projection Practice Committee published in this issue. Every 18 months some "technician" becomes enthused over the possibilities of an "automatic" change-over, and, as an inevitable corollary, projectionists are accused of being "afraid" to lend their support to such a device. Vastly improved photo-electric cells offer hope to the proponents of "automatic" change-overs; but cells or no cells, our view is that the actuating means for the cell will have to be a mark on the film—and we already have enough of this.

Maybe an "engineer" will dream of some means for dispensing with projectionists, and forget about the change-over process.

NEXT month we shall print the first installment of a corking series on mathematics for the projectionist. We tried this stunt before, only to get our fingers badly burned in the attempt—for what we got was mathematics without regard for the projectionist. But this time we smell success, and we hazard the guess that most of our readers will find this forthcoming series as digestible as—as, er—well, as digestible as an argument in favor of four-men shifts.

ALTHOUGH the preliminary injunction issued against certain provisions of the ERPI contract by a Federal Court in Wilmington, Del., does not include any restriction against a continuation of present servicing charges, the plaintiffs are confident that when this point finally is considered a decision favorable to unrestricted servicing will be forthcoming. Meanwhile, projectionist organizations should press hard the advantage gained through the action of RCA in abolishing compulsory servicing. Some routine of servicing is essential, and our stand is that projectionists are entitled to have this work—providing, of course, that they are willing to go out and get it.

INTERNATIONAL PROJECTIONIST

VOLUME V NUMBER 5

JULY-AUGUST 1933

SOUND EQUIPMENT SERVICING BY PROJECTIONISTS

Aaron Nadell

V. Permanent Repairs

SUPPOSE a tube burns out, stopping a show? A new tube is installed, the old one being thrown away. The entire process may have taken less than a minute—a very quick repair job. But, *this is not a permanent repair*. As was pointed out earlier in this series, no repair is complete that does not include every possible precaution against a repetition of the same trouble. After all, the burnt-out tube stopped sound, and sound should not be interrupted. A complete repair of that burnt-out tube trouble may easily require three months.

For one thing, there are tubes that don't burn out, that weaken and lose their "life" after prolonged service, but never stop working without warning. Can a tube of that type be substituted for the one that burnt out, stopping a show? Possibly. Possibly the projectionist will find that there are half a dozen makes of tubes that can be used to replace the one that stopped the show. He may find that choosing among them develops into a complicated question. Some makes or types, safe against burning out, may not be safe against internal short-circuit. Others, safe in both these respects, may yield poor quality, or may have only a short life before they become too weak for further use. Others, still, satisfactory in every way, may seem inordinately expensive, or their source of supply so remote that large numbers of spares must be kept on hand. With all these possibilities to consider, it is easy to see that a trouble which started with a tube burning out, stopping sound momentarily, may not be finally wiped off the books for three months—or more.

Diverse Possibilities

Yet all of the foregoing is only one possibility. Suppose the burn-out was caused by a defect elsewhere in the apparatus? or by high line voltage? or both? Then the repair job becomes really interesting. First, as above, obtain a tube that will not burn out. Fine. But any tube will burn out if the filament current becomes exceptionally large. Next, repair the defect in the equipment that caused the burn-out. This may involve replacing some part with another of different type or make, and therefore all the problems listed above, in connection with the purchase of a new type of tube, must be met in conection with the purchase of a substitute for the weak part in the amplifier, or whatever panel may be involved. Then there will remain the matter of high line voltage, involving more purchasing, this time of a voltage regulator.

All this for a burnt-out tube.

Of course, the above represents an extreme case. Still, some repairs, especially repair of complicated troubles, involve even greater difficulties. It may be worth while to consider a few examples.

Here is a simple trouble: exciting lamp out of focus. How did it get that way? Presumably the lamp was focused correctly, and something jarred it out of adjustment. The re-

pair may call for nothing more than tightening up a set-screw. It may require replacing an exciter socket. Or, investigation may show that vibration of that projector is so serious that exciting lamps cannot be made to hold position, and overhaul of the projector head or the sound drive, or both, may be in order—to repair a mis-focused exciting lamp.

One more example, before going on to other aspects of this question of permanent repairs. Consider the case, of slight scratchy noise, very slight, hardly noticeable, sounding like a dirty rheostat or a bit of wax in the sound aperture. Pounding panels or tugging at wires (after the audience is gone), will reveal the source of the trouble. That source may prove to be a poorly soldered connection; some wire that was beginning to come loose and, if neglected, would have come loose entirely, stopping a show. In that case no pounding or tugging would reveal its location, but the circuits would have to be run down, laboriously, while an audience waited. Repair? Possibly, after inspection, re-soldering half the connections in the equipment, just for a little scratchy noise.

Economic Opportunities

Now, the above examples show that slight troubles may require elaborate repairs, but they also show something else. The alert projectionist will have noticed that every one of the troubles mentioned really is an opportunity in disguise—an opportunity for improvement. The scratchy noise, plainly enough, was an opportunity to avoid a breakdown, and more than that, conferred an additional benefit by calling attention to the precarious condition of some of the soldered connections. The burnt-out tube at least indicated the desirability of using a less troublesome type of tube, with the possible further advantage that the new type might, or might not, prove less expensive. Beyond that it may have revealed an unstable condition in the equipment, causing tubes to burn out—a condition that might cause other and possibly more expensive parts to burn out; or, the burnt-out tube may have directed attention to dangerously defective regulation of the line voltage. Repairing the focus of the exciting lamp may have led to replacing an exciter socket that was about to cause noisy sound, or may have helped draw attention to a sound "attachment" gear in precarious condition.

But, the opportunities to be found in the course of repairing trouble are not limited to improvements in related parts of the equipment alone; often they are also economic opportunities. Any repair opens the question of whether it would not be less expensive in the long run to replace the damaged equipment with new apparatus of an improved type, rather han repair the old; or, to take the other side, if improved models of the particular part in question do not exist, whether it would not be more economical and involve no greater net risk to the show, to replace the damaged part with another, no better but less expensive. Thus, in the case of the burnt-out tube, suppose that no heavy filament tube of that particular type is available, and the risk of tubes burning out from time to time cannot by any means be avoided? In that case, why not use a cheaper tube?

If the show is going to stop for twenty or thirty seconds anyhow, every so often, while tubes of that type are replaced, will it matter much whether those interruptions occur twice a month or only twice in two months? Will the difference be worth the difference in cost? Of course, in such case a great number of other questions arise; for example, will the less expensive tube be more likely to endanger other portions of the equipment?

All the foregoing does no more than illustrate two general rules which are helpful in all repair work: (1) that even slight troubles sometimes involve very elaborate repairs before the repair job can be considered complete, and (2) that nearly every trouble is an opportunity in disguise, but an opportunity which will vary according to the nature of the trouble and to the circumstances of the theatre in which it occurs.

In a previous article of this series the question of temporary repairs was discussed, and it will be remembered that temporary repairs were found to be any expedient that would restore the show to the audience with the shortest possible lapse of time, leaving permanent adjustments to wait until later. The permanent adjustment, then, is one which leaves the equipment not merely in good condition, but in the best possible condition, according to whatever opportunities for improvement or economy the trouble may have suggested; but above all, the permanent adjustment is one in which every practicable precaution has been taken to prevent a recurrence of the same trouble.

Equipment for Repairs

Equipment for effecting repairs on the broad and permanent basis indicated above may be divided into three categories: sources of information, equipment for making repairs, and equipment for testing repairs.

Sources of information have been discussed previously in this series, so far as drawings, blue-prints or specifications of equipment were concerned. The handiest local source of sound technical advice is the local radio man. The projectionist may have occasion to repair an amplifier once in six months. The radio repair man works on amplifiers with nearly the same frequency that the projectionist threads up film. They are pretty much the same amplifiers. They are complicated, for the most part, by radio tuning devices that have no counterpart in the projection room, and they lack many of the refinements with which projectionists are familiar in sound equipment; nevertheless, the local radio man, if he does any quantity of repairing at all, is thoroughly familiar with transformers, condensers, choke coils, resistors, filter circuits, coupling circuits and most of the other circuits and equipment that go to make up a theatre sound system. Moreover, he owns a stock of replacement parts, some of which can be used in case of emergency in the theatre, and he is or should be competent to select suitable emergency parts.

The local radio man does *not,* in most cases, have the projectionists's familiarity with details of theatre equipment and he cannot be expected to understand the requirements of theatre work. Alone in a projection room, most radio men would be helpless, or nearly so. In alliance with a competent projectionist, the local radio man may be of the greatest help; it should be worth while to cultivate his acquaintance.

Not the least of the reasons for enlisting the aid of a qualified radio technician is that, if he does any quantity of repairing at all, he will own expensive test equipment that can be useful in a theatre at all times, and may be invaluable in case of a breakdown. The theatre, of course, should have

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Yager Honored

George A. Yager, business representative of Salt Lake City projectionist local union 250 and a frequent contributor to these columns, has been appointed re-employment director for Utah by Secretary of Labor Frances Perkins under the provisions of the National Recovery Act. Yager, who is the only I. A. man thus honored, is also president of the Salt Lake Federation of Labor, secretary of the Utah State Federation, and chairman of the Health and Safety Committee, Projection Advisory Council.

some equipment; but many smaller theatres will find the cost of a complete test kit rather high. Such theatres might buy a minimum of the testing equipment they should have, trusting to be able to borrow the rest at the radio store, when needed.

The usual screwdriver, pliers and socket wrenches need no mention here; special tools are sometimes in order when working on a sound attachment; in most such cases those tools are furnished by the manufacturer of the equipment. In ordinary work on amplifiers there are only two electrical tools of unusual design—the "diagonal" or cutting pliers, and long-nose pliers. Jack switches are sometimes adjusted with the help of a special jig made for the purpose, but this is not strictly necessary. The soldering iron, however, deserves a word. It should be made for the purpose, neither too light to carry enough heat nor too large to reach into crowded, difficult corners. Sound parts are generally somewhat heavier than radio parts; look at the radio man's soldering iron and then order one about one size larger.

Indicating Devices

Among meters, the volt-ohmmeter is perhaps the most useful, but a trifle expensive, and can be replaced by the volt-ammeter, used in conjunction with a "C" battery. By application of Ohm's Law to the reading of such a meter, resistance can be determined. The volt-ammeter, or the volt-ohmmeter, or almost any meter intended for use with a sound system, should have more than one range of readings. A meter restricted to a single scale will not suffice: a number of such instruments will be needed, and they are more economcially replaced than a single, multi-range device. For the same reason, the volt-ammeter and the volt-ohmmeter are less expensive than separate meters for volts, amperes and ohms.

A little pocket device called "Test-o-lite" which distinguishes between A.C. and D.C. is useful and very inexpensive, although it does not register potentials much lower than 100 volts.

The projection room should have at least one A.C. instrument. The most useful instrument of this type is probably the copper-oxide-rectifier A.C. voltmeter with multi-range scale. Although moderately expensive, this instrument possess the additional advantage of being useful as a volume indicator. It measures volts rather than decibels, but on the other hand it costs only half as much as the more ordinary type of output meter. The output meter calibrated in decibels, and obtainable for any desired line impedance, is useful chiefly in conjunction with test film or records of suitable frequency. These are not readily obtainable, but film exchanges have been known to sell them.

Headphones are very useful for test purposes of all kinds, and for rough tests will substitute satisfactorily for meters. Good quality phones, of about 2,000 ohms impedance, are customarily used. They will not detect a weak photo-cell current, but for testing most portions of the sound system in a quick and moderately accurate way they are invaluable.

Test buzzers should not be used in a sound system, as they pass too much current and may have an undesirable magnetic effect upon the cores of some of the transformers or other windings. For the same reasons, test lamps should be used only with extreme caution; it is best to avoid their use altogether if meters or headphones are available. Ohmmeters, and ammeters used as ohmmeters with the help of a dry battery, should always be set for minimum current flow.

Tube testers are commonly composed of more than one meter. Single-meter testers commonly read plate current only. Most sound systems, amplifiers or other panels in which tubes are used, are equipped with meters that read plate current, so there is no advantage in buying a tube tester for that purpose. Moreover, plate current alone offers only a very limited indication of the condition of the tube. Testers that give more complete information will commonly be found too costly for a single theatre, although chains use them to considerable advantage.

Circuit testers are commonly used by radio repair men in tracing trouble. They have not yet found their way, to any great extent, into theatre work, but in the opinion of this writer, they should. They afford a handy and extremely rapid way of finding trouble, when used by a man who understands the tester and understands the circuits he is testing. To test an amplifier circuit with this device a tube is removed from its socket and plugged into an appropriate socket mounted on the tester. A plug, like a tube base, connected with the tester, is then plugged into the amplifier in place of the tube that was removed. The amplifier then works in the usual way, except that one of its tubes is located in the tester instead of in the usual socket, being connected to the socket by means of a cable and the tester plug. The effect is to put all the meters of the tester into the circuit of that tube. Grid, filament and plate current and voltages can be read, and the approximate nature and location of any trouble is found at once. Some of these circuit testers make excellent tube testers, also. One disadvantage of their use in theatres is that commonly they are not equipped to measure the higher voltages and currents used in some theatre amplifiers. In smaller theatres they will serve almost every test purpose; in larger houses, however, most such testers will have to be modified for use with the power amplifiers.

Permanent Repairs the Goal

Repair equipment (and knowledge) are just one more part of the complicated question of permanent repairs. No trouble, as has been said, is permanently fixed until every reasonable effort has been made to prevent its recurrence. But some troubles—quite a few—can never be wholly prevented from coming back. In that case, the repair is not a complete job until every reasonable precaution has been taken to find and fix that trouble, when it does return, with the least possible loss of time. If an hour was needed to find the trouble last time, only ten minutes should be needed next time; and the repair job is not complete until the knowledge and equipment and spare parts and whatever else may be needed, to keep the time of the next repair down to ten minutes or less, have been made available.

It will be seen that the standard for first-class repair work runs rather high. Few if any theatres or projectionists will care to go to the full extent of meeting that standard at every point. But, probably it will be a long time before the industry as a whole tries to do as much. Nevertheless, here is a standard to aim at; one can only try to come as close to it as his circumstances will permit:

1. No repair is complete until every part of the equipment, whether affected by the trouble itself or the work of testing or repair, has been restored to the best possible condition.

2. No repair is complete until every possible precaution against its repetition has been taken:

(a) by modifying equipment so as to make future appearance of the same difficulty impossible;

(b) by installing an inspection routine that will detect symptoms of trouble, and

(c) by providing repair facilities and instituting repair routines. Tools, meters and spare parts that will help to locate and repair the trouble with a minimum of delay should be available.

'PERMIT' MEN'S STATUS DEFINED BY NEW YORK COURT

James J. Finn

TERMINATING a dispute of five years' standing between opposing factions representing regular card men and "permit" men affiliated with various Locals of the International Alliance, Justice Riegelmann of the New York State Supreme Court in Brooklyn has handed down a decision which determines the legal status of the so-called permit men. Since all but a few projectionist Locals of the Alliance practice the "permit" system, the decision is expected to exert a profound influence among Alliance units throughout the United States.

The case was one of 237 "permit" men against Harry Sherman as president of Local 306, William C. Elliott, head of the parent International body, and William Green, A. F. of L. president. Local 306, alone directly concerned, assumed the brunt of the defendants' burden.

Ruling that the "permit" men were not regular members of Local 306, Justice Riegelmann held that Local 306 need not return the assessments, based on actual earnings, paid to it by the "permit" men during the past five years and that admission to the union of any and all "permit" men must be based on the usual membership requirements of both the parent International body and Local 306. The Justice held, however, that no new members could be added to either the regular members' or "permit" roster of Local 306 until the membership applications of the latter group, filed at the time of their admission as "permit" men, had been either accepted or rejected.

The Justice ruled further that the moneys deposited with Local 306 by the "permit" men by way of initiation fees and security deposits—amounting in the case of Local 306 to $500 for each "permit" man—should be held separate and distinctly apart from the general funds of the Local so that in the event any "permit" man wished to withdraw and cease work under the protection and jurisdiction of Local 306, his money, less offsets by way of unpaid assessments or valid charges against his security deposit, would be available upon demand. The decision also vacated an injunction pending trial previously granted to the "permit" men and by virtue of which Local 306 was prevented from collecting the usual assessment or exercising any control over the working privileges of the "permit" men.

Permit Men Decision Highlights

Permit men are not regular members of a Union, and cannot become such until they qualify according to both Local Union and I. A. constitutions and by-laws.

Deposits paid by permit men at time of application are to be considered trust funds, full amount to be available to any permit man upon demand.

Assessments levied against permit men for privilege of working under jurisdiction of Local Union are the property of the latter and need not be returned.

I. A. Constitution reveals no provision for permit man status.

Permit men's applications must be either accepted or rejected before any new members may be added to either permit men's or regular member's roster.

"Permit" Man or "Apprentice"?

Considerable importance was attached by the Justice to the "permit man agreement" which the plaintiffs signed at the time of their admission and which sets forth clearly the status of the applicant, although significant reference is made to the fact that the Constitution and By-Laws of the International Alliance are barren of any provision for this classification. Also, it is evident that the action of the Alliance at its Columbus Convention in abolishing the "permit man" status and substituting therefor the appelation of "apprentice" and of collecting per capita tax for "permit" men weighed heavily with the Court.

The contention advanced by the "permit" men that, despite the nature of the agreement which they signed upon admission, Local 306 through its officers had waived the provisions of this agreement by utilizing "permit" men for picketing and by promising action "soon" on the "permit" men's applications, was brushed aside by Justice Riegelmann with the statement that the plaintiffs, upon whom rested the burden of proof, had failed to substantiate such claim. Membership requirements of both the I. A. and Local 306 were held by the Justice to prevail, and no court of equity, he said, had the right to usurp these natural functions of a labor organization in making its own rules and administering its laws governing admission of members.

Reflecting the possibility of a very different decision had the Justice abandoned strictly legalistic tenets in favor of a broadly equitable judgment of the matter, is that portion of the decision which reads: " . . . in view of the fact that the necessary requirements for membership have not been complied with, *irrespective of any views the Court may have as to the desirability of plaintiffs being accorded membership in the Union* and the hardships which they claim a denial thereof may entail, the provisions of the Constitution and By-Laws above referred to are controlling and the Court is *without power* to declare plaintiffs members of Local 306."

Membership in an unincorporated association was the subject of two abstracts of previous decisions. One of these (McKane v. Adams, 123 N. Y. 609, 192) states:

" . . . The right to be a member is not conferred by any statute; nor is it derivable as in the case of an incorporate body. It is by reason of the action and the assent of the members of a voluntary association that one becomes associated with

them in the common undertaking, and not by any outside agency or by the individual's action. Membership is a privilege, which may be accorded or withheld, and not a right, which can be gained independently and then in force."

Another decision was cited (Branagan v. Buckman Misc. 242,247) as follows:

" . . . Such membership is a privilege which an association may accord or withhold at its pleasure; and a Court of Equity has no jurisdiction to compel the admission of a person not regularly elected, even though, as in the case of a political organization or labor union, the arbitrary rejection of a candidate may prejudice his material interests."

The decision of Justice Riegelmann expresses the conviction that at no time were the plaintiffs in doubt as to their status, and that they paid their weekly assessments for "the privilege of securing employment under Union auspices, which they could not otherwise obtain." On this basis, the Justice held that Local 306 need not return the assessments, based on earnings, paid to it by the "permit" men. The decision then proceeds to treat with the handling of the "permit" men's deposit money and also with the manner in which their applications for membership may be disposed of, as is set forth in a complete copy of the decision appended hereto.

Labor Leaders Hail Decision

Labor leaders in various crafts affiliated with the A. F. of L. hailed the decision as a sweeping vindication of the right of organized labor to govern the conditions of membership and to control the working rights of members working under the protection and jurisdiction of a union. Voluntary associations, such as unions, are held by labor leaders to be just that and not subject to those laws which apply to corporate bodies—a status which has been recognized by practically every court in which the matter was at issue.

No reprisals and a continuation of the policy of extending every consideration to the "permit" men was assured by President Harry Sherman of Local 306, following the handing down of the decision. "Justice Riegelman's decision upholds our every contention throughout the trial of this case," said Sherman. "The claim of the 'permit' men to full membership in Local 306 demanded preferential treatment for a group of men who, having come under the protection of the Local in recent years and thus contributed nothing to its upbuilding, utterly ignored the rights and privileges of those regular members many of whom have given their best efforts to the Local for more than 20 years. This was the salient feature of the case, as I see it.

"Those portions of the decision relating to the handling of the 'permit' men's deposit funds and to the procedure to be followed in possible future admissions of either regular or 'permit' men merely confirm the usual practice of Local 306 to date."

Sharp dissent from the decision was expressed editorially by the New York *World-Telegram,* which has interested itself in the affairs of Local 306 and the I. A. for more than three years now. Criticizing the findings of Justice Riegelmann, this newspaper advocated action on the part of Local 306, the I. A. and the A. F. of L. in the matter of ignoring the decision and proceeding promptly to "set its own house in order" without relying upon court decisions. It also stated bluntly that the present decision might well have been based not on strictly legalistic tenets but rather on the basis of equity and humanitarian precepts.

Counsel for Local 306 in the action were Charles H. Tuttle and Samuel Birnbaum, New York attorneys, who also acted for the I. A. in the case of Kaplan v. Elliott. Well-informed legal opinion holds that the chances for a reversal of the Riegelman decision on appeal are remote.

"Permit" System Genesis

The so-called permit system came into vogue within the I. A. with the introduction of sound pictures in 1927. Local Unions, sorely pressed for additional manpower in order to satisfy the demand created by sound picture projection, but being somewhat afraid that sound pictures might prove to be the novelty that many people held them to be, seized upon the "permit system" as a means for giving them the manpower sought without obligating them in any way to accept these new men as regular members. Union leaders reasoned that once a member always a member; and if sound pictures failed to demonstrate popular appeal and lasting qualities, they could easily dispose of non-member "permit" men.

Undoubtedly, general opinion throughout Alliance ranks was that within two or three years at most conditions within the industry would adjust themselves to a normal level and thus point the way to disposition of the "permit" man problem. Sharply shifting economic conditions, with accompanying evils of closed theatres and widespread activity on the part of dual unions, however, made it necessary to postpone indefinitely the solution of this vexing problem.

At Columbus in June, 1932, a General Convention of the I. A. abolished the "permit" man classification and substituted therefor an "apprentice" rating, and at the same time passed legislation diverting a part of the income derived by Locals from "permit" men to the I. A. in the form of per capita tax. This piece of legislation almost proved the undoing of many Locals with large "permit" rosters, many lawyers holding the action to constitute *prima facie* evidence of an acknowledgement on the part of the I. A. of the membership status of the "permit" men.

It appears highly improbable that the decision by Justice Riegelmann will settle permanently the "permit" man question, although it is regarded as providing a breathing spell during which time the various I. A. locals might devise ways and means for disposing of the matter.

The decision in full follows:

SUPREME COURT: KINGS COUNTY

MAX ALTERMAN, et al,
Plaintiffs,
against
HARRY SHERMAN, et al,
Defendants.

This is an action brought by 237

(*Continued on page* 27)

Trailereel An Excellent Projection Aid

TRAILEREEL, an excellent projection aid, has just been brought out by Harry Abery, member of Hartford (Conn.) Local 486. Several samples submitted to INTERNATIONAL PROJECTIONIST by Mr. Abery have been subjected to exhaustive tests and have accomplished as much as and more than is claimed for them. The device, designed especially for rewinding trailers, etc., is made of well-finished aluminum, with a hub of slightly more than one inch in diameter. It has the usual opening and keyway for the rewinder standard, with one side being a solid disc about 1/8 of an inch thick and 6 inches in diameter. It is cast in one piece and is fully guaranteed.

The projectionist has only to place Trailereel on a rewinder to be able to expeditiously rewind trailers, etc., and is able to slip them off the reel in compact form ready for either storage or shipment. Heretofore this work has been very bothersome because of the lack of such a reel.

Trailereel has been thoroughly tested under actual working conditions by several projection supervisors, who have praised it highly. It will be sold by Mr. Abery through the Trailereel Mfg. Co., P. O. Box 35, East Hartford, Conn., at a surprising low price of $1 on a money-back if not satisfied basis. INTERNATIONAL PROJECTIONIST endorses this product.

PRACTICAL PROBLEMS OF THE PROJECTIONIST

REPORT OF PROJECTION PRACTICE COMMITTEE, SOCIETY OF MOTION PICTURE ENGINEERS

Unquestionably the greatest factor in elevating projection standards is the Projection Practice Committee of the S. M. P. E. Here is a group of unselfish individuals who work throughout the year, their common purpose the raising of projection standards, their work unattended by ballyhoo and their only reward the satisfaction in a job well done. Craft recognition and cooperation is denied this group, surprisingly enough, despite their record of accomplishment and the fact that there exists no modern projection room that does not reflect the influence of this Committee.

International Projectionist is proud to publish the findings of this Committee and prouder still to list here the names of this unselfish group of men worthy of the name of craftsmen:

HARRY RUBIN, Chairman

J. O. Baker	**Sam Glauber**	**R. H. McCullough**
Thad C. Barrows	**Chauncey Greene**	**P. A. McGuire**
George Edwards	**Herbert Griffin**	**Rudolph Miehling**
James J. Finn	**Jesse Hopkins**	**F. H. Richardson**
C. Flannagan	**W. C. Kunzmann**	**Victor Welman**

PROJECTION provides the industry's closest contact with the public, whose continued patronage is dependent largely upon the quality of the projected picture and the reproduced sound—the finished product which embodies the work of all other branches of the industry. Acceptance of the foregoing fact leads naturally to a consideration of the means available for maintaining at all times a high standard of quality. The Committee feels that every facility that aids, even remotely, in maintaining a high standard of projection should willingly be provided.

A serious deficiency in the projection field heretofore has been the lack of an efficient test medium that would enable the speedy and convenient detection and correction of various defects common to both visual and sound apparatus. To meet this requirement, the Committee, in collaboration with the RCA Victor Company, Inc., has devised a test reel that serves two distinct purposes in that it provides a means of accurately checking both the visual and the sound equipment. This film is suitable for use on all makes of equipment arranged for projecting films that conform to the specifications of the Standard Release Print.

The test reel is about 1,000 feet long, of which about 500 feet are devoted to various targets (test objectives), to be used for detecting optical defects, the remaining 500 feet providing various means of testing sound quality. The latter section has sound tracks on both margins of the film, thus providing an effective test footage of approximately 1,000 feet.

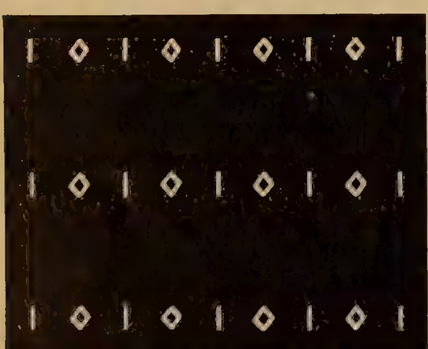

Fig. 1. Travel-ghost target

Optical Test Section

The "optical" section of the test film will be considered first. It contains five test targets with appropriate descriptive legends in the following order:

(1) Travel-ghost.

(2) Picture-jump.

(3) Vertical lines for testing marginal and radial aberration of the projection lens.

(4) Horizontal lines for testing the marginal and radial aberration of projection lens.

(5) Small squares for checking focus.

1. Travel Ghost Target (Fig. 1).—Unless the shutter is properly adjusted and timed, "travel-ghost" will be evidenced by the blurring of the bright portions of the screen into the dark portions, with resulting loss of detail in the vertical direction. The target consists of white geometric forms on a black field. Travel-ghost may be considered to have been eliminated when the outlines of these white forms are clearly and sharply defined on the screen against the black field.

2. Picture-Jump Target (Fig. 2).—This target consists of two rows of white rectangles placed corner to corner along the diagonals of the screen image, against a black field. The amount of picture-jump can be measured with a ruler held against the screen at the top or bottom of any of these rectangles. By holding the ruler to the vertical side of any of these rectangles, the amount of side-motion, or weave, may be determined.

3. Vertical Line Target (Fig. 3).—This target consists of a series of white vertical lines against a black field. Projection of this image in sharp focus *over the entire area of the screen* by a lens in one position, in this and in the following test, stamps the lens as one that is commonly referred to as having a "flat field." If, on the other hand, marginal aberration is present, it will be indicated by a blurring of the lines at the sides of the screen. Radial aberration will be indicated by a blurring of the lines at the top and bottom of the screen.

4. Horizontal Line Target (Fig. 4).—This target serves the same purpose as the preceding target, except that it is partly intended to compen-

sate for visual deficiency (astigmatism) of the observer.

5. Small Squares Target for Checking Focus (Fig. 5).—This target consists of numerous white squares, arranged and numbered in vertical and horizontal rows, against a black field. The position of the lens for which the greatest possible number of squares are projected in sharp focus is the most desirable lens position. The numbering of the squares provides a means for making comparative tests of lenses.

Sound Test Section

The remaining portion of the test film, some 500 feet long, is recorded on both edges, as previously stated. On one side of the film are recorded the following tests with suitable accompanying announcements:

(1) Buzz track for checking the position of the scanning light relative to the sound track.

(2) 6,000-cycle and 9,000-cycle constant frequency tracks for checking the focus of the sound optical system.

(3) Selected frequencies for ascertaining the over-all characteristics, as follows: 50, 100, 200, 300, 500, 1,000, 2,000, 3,000, 4,000, 5,000, 6,000, 7,000, 8,000, 9,000, and 10,000.

1. Buzz Track.—This consists of a 300-cycle and a 1,100-cycle frequency recording, respectively, just outside the boundaries of the standard sound track area, one on each side. When the 1,100-cycle note (the higher pitched note) is heard, it indicates that the film is passing the light slit too closely to the sprocket hole margin. When the 300-cycle note (the lower pitched note) is heard, it indicates that the film is passing the light slit too closely to the picture margin. When both notes have been eliminated by properly adjusting the lateral guide rollers, or by adjusting

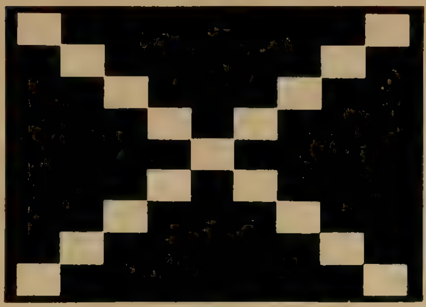

Fig. 2. Picture-jump target

the optical system, when such adjustment is provided, correct film travel path may be assumed. When one or both notes are *intermittently* heard, this indicates film weave. If the weaving be due to warping of the film, its effect may in some cases be reduced by adjusting the sound gate tension springs. Incorrect relative alignment of the projector head and the sound head also may cause weaving.

2. 6,000-Cycle and 9,000-Cycle Constant Frequency Tracks.—When the maximum volume of sound is obtained for each of these frequencies, it may be assumed that the optical system is correctly positioned for obtaining the best results; that is, that the scanning light is sharply focused *and* perpendicular to the direction of travel of the film. The 6,000 cycle note is used for making an approximate adjustment, and the 9,000-cycle note, if audible, for still finer adjustment. This positioning should not be undertaken unless the optical system has been specifically designed to be adjusted and suitable adjusting tools are available.

3. Selected Frequencies. — This track is so recorded that no voltage calibration (on a volume indicator) is required. Assuming a perfect scanning slit and a "flat" amplifier, the resulting over-all characteristics, as determined by a volume indicator, would be flat. The ear will naturally be more responsive to the 1,000-cycle note, whereas the higher and lower frequency notes will sound less loud. Of course, a volume indicator would admit of making precise measurements of the sound level; this applies equally well to sections 2 and 3 above.

On the other edge of the sound test film are recordings of voice, piano, and orchestral music. The vocal portion is to be used for testing intelligibility of speech and theatre reverberation; the piano recording for detecting flutter ("wows"); and the orchestral recording for noting the naturalness of reproduction, which is determined by the range of frequencies reproduced by the equipment. This recording contains notes ranging from the lowest notes of the tuba and double bass to the very high overtones of the string and brass instruments. The metallic quality of special instruments, such as the wire brushes, should be particularly noticeable.

Optical Alignment Tool

In conjunction with the test reel, the Committee recommends a tool to be used in aligning the arc, condenser, projector aperture, and projection lens on the optical axis. The model, designed by the Committee, and referred to in the following description, conforms to the standard 13.6-mm. carbons used in high-intensity lamps. To obtain the maximum illumination and most uniform distribution of light on the screen, it is of prime importance that the arc and all components of the optical system be accurately centered. Fig. 6 shows the several parts of this tool:

A is a disk having a hole through the center, which is placed in the condenser mount instead of the condenser. *B* is a cylinder having an axial

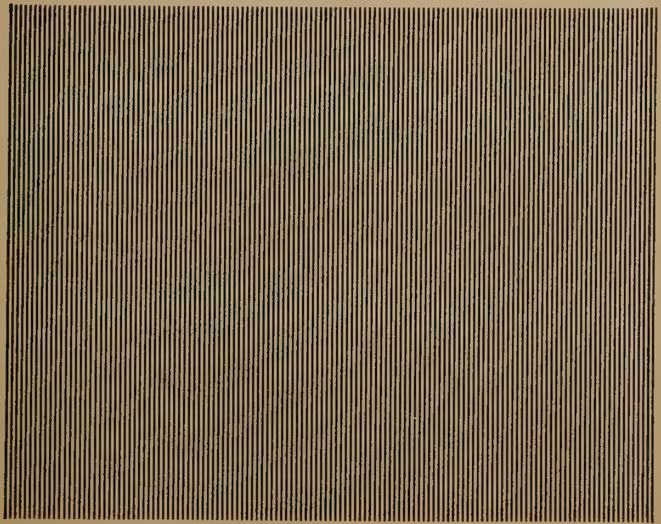

Fig. 3. Vertical line target for testing aberration of lens

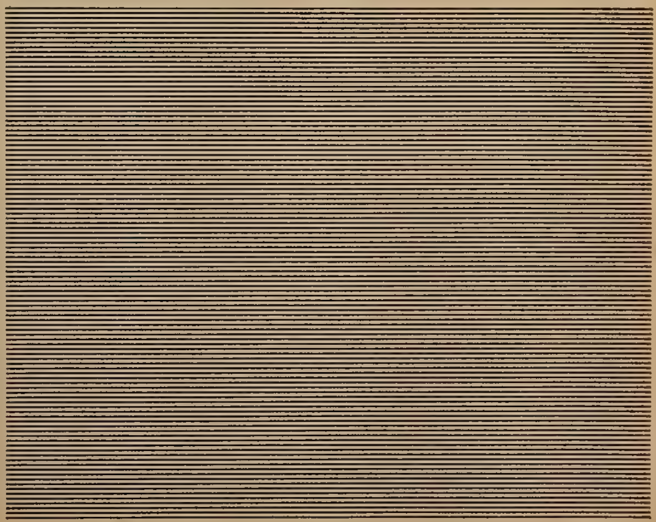

Fig. 4. Horizontal line target for testing aberration

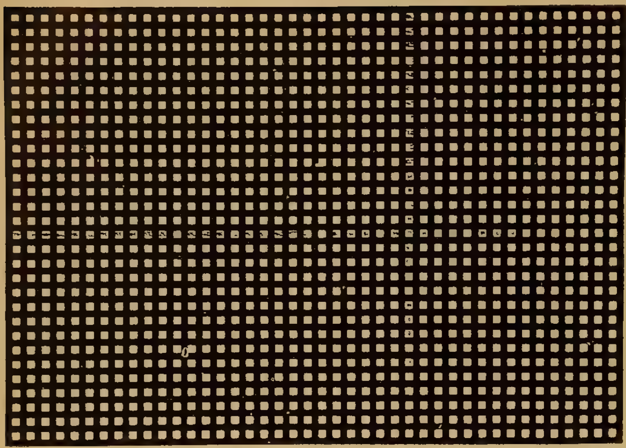

Fig. 5. Small squares target for checking focus

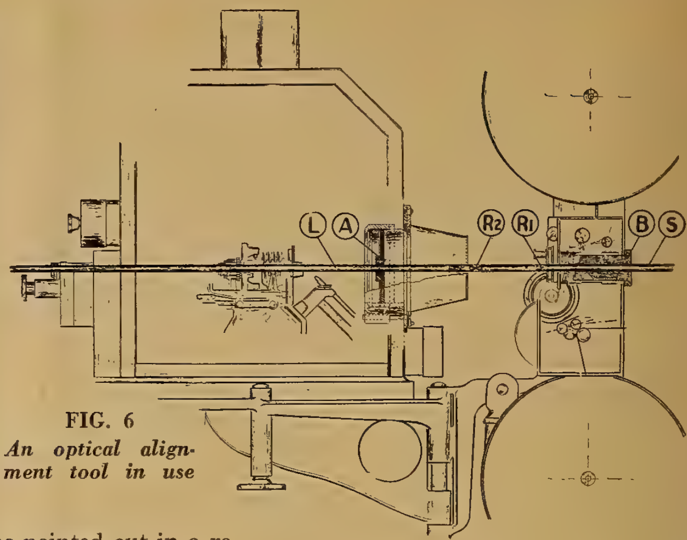

FIG. 6
An optical alignment tool in use

hole through the center, which is clamped into the projection lens holder. *S* is a short pointed bar, which is inserted through cylinder *B* and extended through to the aperture of the projector. The bar should be in the center of the aperture. An aperture plug having a centered circular hole with clearance for the bar can be provided as an additional convenience.

L is a pointed bar, 36 inches long and approximately ½ inch in diameter (the approximate diameter of the 13.6-mm. positive carbon), which is inserted through the back of the lamp house, through the positive carbon clamp and through the disk *A*, which occupies the position of the condensers. This bar, which replaces the positive carbon, should be aligned along its entire length with the center of the condenser mount. The bar is then extended to the aperture where, by manipulating the arc housing on the base of the projector, the points of the two bars, *L* and *S*, may be aligned, as at R_1.

Subsequently to this alignment, a confirmatory test is made by drawing the long bar back toward the disk *A* and extending the short bar through the aperture so as to touch the point of the long bar as indicated at R_2. Further manipulation of the arc housing may be required before the bars are exactly aligned. After this operation, it should be possible to withdraw bar *S*, the smaller one, and extend bar *L* through cylinder *B* without difficulty. (This device is a modification of a similar piece of equipment used on a limited scale some years ago. The Committee strongly recommends a much wider use of this tool.)

IT has been definitely established that the intensity of illumination of the screens used in most studio projection rooms is greatly in excess of the intensity that can be obtained in theaters. The great disparity that was found to exist was pointed out in a report of the Theatre Lighting Committee, published in the February, 1931, issue of the *Journal.* Complaints regarding dense prints still persist, however, indicating the need for additional emphasis in the matter.

The Projection Practice Committee has conducted a partial survey of typical theaters for the purpose of determining the values of screen illumination obtaining in practice, and it is significant that its findings, in a widely separated territory and after a lapse of two years, check closely with the findings of the Theater Lighting Committee referred to previously.

The results of these two independent surveys indicate that the average intensity of the projected light at the surface of theater screens lies between 8 and 12 foot-candles, and that the average coefficient of reflection is about forty per cent, corresponding to intensities betwen 3.2 and 4.8 foot-candles, these figures being based on the use of diffusive screens.

In the tests made by this Committee, each projector was equipped with a two-blade, 90-degree shutter which caused a reduction of approximately 50 per cent of the screen illumination as compared with measurements made when the projector was at rest. In each test, the auditorium illumination approximated that obtaining during the presentation of pictures.

Studio vs. Theatre Practice

Invariably much smaller pictures are projected in the studio projection rooms than in the average theater, resulting in excessive screen illumination. In addition, reflective screens are sometimes used in studio rooms, adding further to the brightness of the projected picture. In the great majority of theaters, however, not only are much larger pictures projected than are shown in the studio rooms, but, in addition, diffusive screens are used. It is obvious that under such circumstances it is extremely difficult to reconcile studio "screen values" with theater "screen values," unless some compensating adjustment is made in the studio room. It seems highly desirable that no reflective screens be used in studio rooms in which print density is to be judged.

On the basis of these facts, therefore, and in view of the easy and inexpensive manner in which the requisite change can be made, the Committee suggests that in each studio projection room where the screen illumination is excessive, each projector be provided with a diaphragm or iris in front of the lens to reduce the flux of projected light while measurements of screen illumination are made. The iris can be so adjusted that the screen reading approximates the average value obtaining in the theaters, after which a diaphragm mask having a fixed aperture of the proper size can be substituted at will for the iris.

Change-Over Mark Location

It is obviously not good practice to attract the attention of the audience to the marks used for start-motor and change-over cues. Attention will, however, be drawn to the marks if important action occurs near them.

Neglect of a corresponding precaution has resulted in giving undue prominence to change-over marks in certain recent feature films. Greater care in arranging the location of the indicating marks would prevent such occurrences. The placing of indicating marks should be in accord with desirable practice, as follows:

(1) No motion of objects directly toward or away from the mark is desirable, and

(2) The marks should not be placed over moving objects or near significant action.

The first requisite is that the in-

dicating marks shall be properly positioned; and next, that they shall be visible to the projectionist. Unless both these requisites are satisfied, the crude punching and marking of film by individual projectionists will undoubtedly continue, if not actually increase, and cause a pronounced loss of entertainment value and waste of film stock.

The Committee proposes that the studio experiment with marks of different shape, in order to distinguish between start-motor and change-over cues; *e. g.*, a diamond for a motor-starting mark and a circle for a change-over mark. This is an added safeguard against faulty changeovers.

In view of the fact that prints having marks that are not sufficiently visible from the projection room still are being released, the Committee feels justified in referring again to the suggestion made in its preceding report—namely, to surround each black indicating mark with a thin white circle that will be visible against a dark background. Two of the major film producers have acknowledged the value of this suggestion and have adopted it in practice.

Discussion:

DR. GOLDSMITH: The company that has made the negative of the test reel, the RCA Victor Co. has stated to the Society its willingness to make prints and to furnish them to the Society or others upon the request of the Society. That is, the Society can buy the prints and ship them, or the Society can act to instruct the maker of the prints to ship them.

The Board of Governors has had data on that subject laid before it, but has not yet fixed on a definite price for the prints, because there are shipping costs and handling costs which the Society must consider. It is likely that as soon as, and if, this reel is accepted and suitable prints become available, the Society will undertake to announce to the theatres that this reel is available; and that theatres, exchanges, laboratories, or others who wish such a reel for test purposes, can address the headquarters of the Society. By sending a suitable remittance, for the reel and for the shipping and handling charges, such a reel will be then sent to that theatre exchange, laboratory, or other organization. In other words, the Society would become the clearing house through which the test reels will reach the theatres, and the Society will instruct the shipper to whom to send them.

That procedure may not be the one that may be adopted. It is too early to make a definite statement and it must be understood that I am speaking unofficially. The Board of Governors has not as yet ruled on the matter.

MR. RICHARDSON: It seems to me that the Society itself might perhaps offer to furnish these reels at a fair rental and to recommend that all exchanges carry at least one copy of the film for rental to their customers.

Distribution Plan

DR. GOLDSMITH: The superior facilities of an exchange for arranging the rental and for collecting the rental fees, would make the exchange a more logical agency for distribution. We would have some hesitancy in saddling the office of the Society with the task of arranging for the rental of these films, perhaps to hundreds of theatres per month, and then arranging for the collection of rentals, the shipping of the film, and the like. Our natural inclination would be to let an exchange, that was interested and that believed that the Society's recommendation of this test reel was valid, buy such a film from the Society and rent it until the reel no longer was usable, and then buy another one. In other words, the exchange would handle these films in much the same way that it would any other theatre film.

MR. RICHARDSON: In the legend accompanying the travel-ghost target, the projectionist should be warned that he can not detect a faint travel-ghost from the projection room, especially when the projection distance is long; not even with an opera glass. It is necessary to approach within 25 feet of the screen, at least, in order to be sure that faint travel-ghost is not present.

MR. TUTTLE: I do not believe that the definition test is sufficiently critical. Some sort of pie chart, or a series of pie charts, might be more critical. When making the steadiness test, one notices not only the steadiness of projection, but the steadiness of the print as well. We assume that the print will be accurately made, but I wonder whether an accurately punched film, the perforation of which would show on the screen, would not be a better kind of test object to use. Also, I believe that the aberration test object would be somewhat better if the horizontal and vertical lines were closer together.

Proper Test Targets

MR. KURLANDER: Like Mr. Tuttle, I feel that some of the test objects used in this film are too elementary to do what they are designed to do. Certainly, any method, to be an improvement over the means already at the disposal of the projectionists, must be more precise than those described.

With respect to the first test object, as Mr. Richardson pointed out, he recently had to go within 25 feet of the screen in order to detect travel-ghost. That wasn't the projectionist's fault; the travel-ghost was present, but he couldn't see it. It seems to me that an adjustment when once made, should be permanent, and should be made carefully and very critically. If we give the projectionist the proper kind of target, he will be able to make those critical adjustments precisely. Instead of the travel-ghost target used in this report, I recommend that the travel-ghost figure be made up of alternate white and black horizontal bars of equal width. A slight amount of travel-ghost would cause the white bars to increase in width at the expense of the black bars. This would result in an alteration of the entire pattern that would be easily detected.

As travel-ghost increased the white bars would become broader and the black bars narrower, until finally the black bars would disappear entirely and the pattern would consist of alternate white and gray bars.

It is extremely difficult to detect an increase in the width of a white line; but it is comparatively easy, with a regular pattern, to detect a change over the whole pattern and I would suggest that horizontal bars of equal width be used. The best width would have to be determined experimentally.

A test for lens definition was described some time ago in the *Transactions* which consisted of a fine engraving of various characters in the form of an over-all pattern. Such an engraving would seem to be necessary in order to determine whether or not the lens is a good one. The proposed bar pattern seems too crude for the purpose.

As for the optical alignment tool, it is not new. It was used in the days of Mazda lamp projection, and the greatest drawback to its extended use was its cumbersomeness. In the first place, it is a little awkward to make. The average projectionist probably would not go to the trouble of making such a tool, as it is a machine job. I would suggest some optical method instead of the alignment tool.

As regards the use of an iris diaphragm for framing, I would suggest that the statement be made in the report that the iris diaphragm should be placed over the mouth of the projection lens. It can be used also to diaphragm the condenser; or, in a similar manner, to diaphragm the mirror of the reflector arc. The most logical way, however, is to diaphragm the projection lens.

With respect to screen intensity, I am not so sure that high intensities should not be used in the screening rooms of studios. Screening is an inspection process, and the observers ought to be very critical; certainly they should inspect films under a much higher intensity than that to be used in the theatres. It seems to me that the point to be stressed is the standardization of print density.

Now, with respect to the change-over marks, we have all the elements in a modern projector for changing-over automatically. There are present

(*Continued on page* 23)

News

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TRIAL of what is expected to be one of the most sensational court cases in New Jersey union affairs got under way in Newark, N. J., July 25. Plaintiffs are eleven "junior" (permit men), members of the Newark projectionist I. A. unit against Local officers including Ray Cooper, president; Louis Kaufmann, B.A.; and Harry Oppenheimer, secretary. The I. A. also is named as a defendant.

Case closely parallels recent Local 306 squabble, with first move by "juniors" being a request for immediate appointment of a receiver. Complaint generally recites the old, old story: officers enriching themselves at members' expense; "gifts" in the form of $5,000 cash every Christmas for several years; purchase of automobiles for officers; depletion of Local's funds; payment by theatre of salary direct to Union, with worker calling around collecting only 50% of pay; "grafting" on sound installations; illegal "taxation" of permit men, with boasting that no "junior" would ever become a "senior," and various other charges including one charging assessment against Local for dental work ordered by an officer, and another involving the inevitable purchase of "several" automobiles for officers.

Newark projectionist Local dominates its territory, thus case is getting fine airing in newspapers, most of which are definitely antagonistic. Mystery element in the case involves source of permit men's financial backing, noted lawyers being retained, and a last-minute shift of attorneys by defendant officers who first engaged lawyers of own choosing and then shifted to Rubien & Bregoff, attorneys for the I. A. Most serious charge is that defendants forced falsification of members' income tax returns to cover up "gifts," thus injecting Federal men into case.

I.B.E.W.—I.A. Fight Causes Studio Walkout

PRODUCTION was brought to a standstill in eleven West Coast studios by action of Richard ("Dick") Green, I. A. studio crafts boss, in calling a general strike of all I. A. studio workers. Call affected Sound Technicians, Local 695; Cameramen, Local 659; Film Technicians, Local 683; Projectionists, Local 150; Studio Mechanics, Local 37, and all lab workers, cutters and film editors. Green announced that unless a speedy settlement was effected all projectionists and stagehands working in theatres affiliated with studios would be called out.

On its face strike was called in support of sound men who asked for 48-hour week, time and one-half after 8 hours, and double time after 16 hours, with recognition in form of title credit. Real low-down on situation contained in direct advices from West Coast to I. P. is that I. B. E. W. (electricians) are trying to force the issue of jurisdiction and "muscle in" on I. A. studio control. Fight has been shaping for sometime, say I. A. men, with studios first fighting point and, if I. B. E. W. is successful, an extension of campaign to theatres. I. B. E. W. has never recognized I. A. control of picture work, with jurisdictional battle raging hot and heavy for five years now. I. B. E. W. claims A. F. of L. sanction of their control over picture work, studio and theatres.

Green is confident I. A. will win, but plenty damage is expected as result of feud between I. B. E. W. and I. A. Unquestionably the A. F. of L. will have to settle this fight soon, as studio situation has been called directly to President Roosevelt's attention by active motion picture political workers. A check-up by INTERNATIONAL PROJECTIONIST of West Coast reports that I. B. E. W. secretly is girding for theatre field fight indicates that about 1,300 I. B. E. W. men hold projectionist licenses in New York City, and that similar condition exists in other key cities.

I. A. units say that settlement was reached with studios but that Pat Casey, producer labor contact man, blocked it. Casey replied that he had no choice, being "between the devil and the deep blue sea" because of threat by I. B. E. W. to stop all power production if I. A. demands were recognized. Thus, jurisdictional battle was brought out into the open.

Academy Code Based on "Fair Competition"

ACADEMY of P. M. Arts & Sciences, circularizing its membership relative to a picture industry code, bellows long and loudly that the solution of "all the problems" of the industry is "fair competition," under which, states the Academy, "no company can be stupid, can over-pay or over-build and remain in business." The influence of the Academy, codewise, in the theatre field is negligible, but it appears that the studio labor units will have to concern themselves about the Academy attitude.

Servicing Not Included in Erpi Injunction

SERVICING was not included in a temporary injunction signed by Federal Judge Nields in Wilmington, Del., in the case of Warner Bros., Duovac, and General Talking Pictures against A. T. & T., Western Electric and ERPI. Plaintiffs asked that ERPI be restrained from servicing theatre sound equipments and collecting payment therefor. Signed injunction pending trial was issued against ERPI contract clauses which provide that the theatre shall obtain replacement parts exclusively from ERPI and that ERPI recorded sound pictures be distributed only to theatres having W. E. equipment.

Case will now go to trial, and question of servicing will be tried on its merits along with other issues involved. Plaintiffs are asking triple damages in return for alleged monopolistic practices of defendants.

Independent Supply Men Meet in Chicago

THE Independent Theatre Supply Dealers Association met in Third Annual Convention at the Hotel Stevens, Chicago, July 28-31. The Association numbers among its members 20 independent supply houses in 17 key cities of the United States. J. E. Robin, well known projection engineer, is president, and Les Dolliver, of San Francisco, is vice-president.

More than a score of manufacturer representatives attended the Chicago sessions, and most of them displayed their latest equipments. Business sessions were open to members only, but everybody who wished to address the dealers was permitted to do in a series of open forums, with no topics of interest to dealers barred.

Brevities

Herbert Griffin, sales manager of International Projector Corp., has just returned from a six weeks' stay in Europe. "Griff," as he is known to thousands of projectionists, visited all the principal cities in Eastern Europe, where he transacted business with Simplex dealers and investigated projection processes. Possibly—but not positively—"Griff" will set down some foreign projection facts for I.P. readers. (Tentatively scheduled for our January, 1934, issue.—Ed.)

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RCA Victor Co., manufacturers of High Fidelity Photophone sound equipment, announces a 10 per cent increase in wages for all hourly rated and piecework employees. Action was taken preceding submission of code for radio industry.

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Larry Strong, member of Local 110 and president of Essanay Electric Mfg. Co., Chicago, was a recent New York visitor. (Running away from the Century of Progress.) Essanay's new home is at 823 South Wabash Ave., Chicago.

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The full executive board of the International Alliance convened early in July in New York City for the regular summer meeting. The usual business was transacted, with Messrs. Holmden and Nick staying over for consultations on codes for stagehands and projectionists.

THE DECIBEL AND ITS USES

D. C. McGalliard

OPERATING MANAGER, ELECTRICAL RESEARCH PRODUCTS, INC.

PROBABLY no technical term in sound motion picture work is so frequently used and so little understood by the non-technical man as is the unit by which sound intensity is measured—the decibel. To the technical men accustomed to electrical units and mathematics, it presents little difficulty, but to others it is apt to be confusing, not because it is complicated but because little has been written concerning it for the non-technical man.

The word "decibel" (abbreviated "db"), was formed by combining "deci," meaning one-tenth, with "bel," the fundamental unit named in honor of Dr. Alexander Bell, the inventor of the telephone. It is the direct outgrowth of Bell System communication engineering practices and meets the need for a unit by means of which one amount of energy, which may be either in the form of electricity or sound, can be compared with another. In making such a comparison, we could say, for instance, that one energy is twice as great, ten times, a thousand times, or a hundred million times as great as another. Such large numbers are obviously inconvenient to use. For instance, the energy of the loudest sound the human ear can tolerate is greater than the energy of the faintest sound the ear can detect by several million times. A more simple system of working with these large numbers is therefore desirable. The decibel furnishes such a system.

Mechanics of Hearing

Before discussing the matter further, it will be helpful to consider briefly how the ear responds to sounds of different intensities. That the human ear is a remarkable mechanism is apparent from the figures given above. The reason for the peculiar ability of the ear to handle wide ranges of sound energy is that the impression of intensity is, fortunately, not directly proportional to the amount of sound energy reaching the ear. What is meant by this can perhaps best be illustrated by considering two glass water tumblers of about the same capacity, one the conventional cylindrical tumbler, and the other shaped like a funnel or an inverted cone. If we fill these tumblers with water a spoonful at a time, the level of the water in the cylindrical one will rise by the same amount each time a spoonful is added. The level of the water in the funnel-shaped tumbler, however, will rise rapidly at first, but as it becomes more nearly filled the increase in level resulting from the addition of a spoonful can scarcely be noticed.

The human ear responds to sound in much the same way as the water level in the funnel-shaped tumbler does to water. As the sound energy is increased in equal amounts, the added sensation of intensity (loudness), resulting from these increases becomes less and less. If, however, each time the sound energy is changed it is increased by the same percentage of its previous value, the result will be equal increases in the sensation, that is, it will appear to get louder in equal steps. This is indeed a wise provision of nature since it makes the ear sensitive to weak sounds and at the same time protects it from the loud sounds. It is important that this principle be constantly kept in mind, as it will be of considerable aid in obtaining a clear understanding of the subject.

Without going into the mathematics of the subject, let us examine the following table of numbers:

Column A (Ratios)	*Column B* (Bels)	*Column C* (Decibels)
1	0	0
10	1	10
100	2	20
1,000	3	30
10,000	4	40
100,000	5	50
1,000,000	6	60

A brief consideration of these figures makes it very evident that there is a definite relation between the figures in these three columns. The figures in Column B obviously represent the number of times the number 10 must be multiplied by itself to give the larger figures shown in Column A. The figures in Column C are ten times the corresponding figures in Column B. Since there is this definite relation between Columns B or C and Column A, evidently we can make unnecessary the handling of the large numbers shown in Column A if we work with the figures in Columns B or C instead.

Convenience in Calculating

If now we consider Columns A, B and C, not as simple figures but as power ratios, bels and decibels, respectively, the relationship involved is apparent. By "power ratio" we mean the number of times the larger of the two powers being compared is greater than the smaller. Thus, if we are comparing a power of 2 watts with one of 20 watts, the power ratio is $\frac{20}{2} = 10$.

Aside from avoiding the handling of large numbers, there is another advantage, perhaps even more important, in using bels or decibels in Columns B or C instead of the power ratios in Column A. In combining two power ratios, we must multiply or divide them, whereas the corresponding bels or decibels need only be added or subtracted. For example, if one amplifier increases the sound energy 100 times and a second amplifier takes the output from the first one and increases it 10,000 times, the total increase has been 100 x 10,000 = 1,000,000 times. From the table we see that power ratios of 100, 10,000 and 1,000,000 correspond, respectively, to 20, 40 and 60 decibels. It is evident therefore that the total increase could have been figured much easier by simply adding the decibels corresponding to 100 and 10,000 (20 + 40 = 60) and then referring to Column A for the answer. Unfortunately, in actual practice power ratios do not often come out round figures such as 100 or 10,000 as used in the example given; they are much more likely to be uneven figures, such as 96 or 9,585. The advantages of using decibels are usually much greater, than would appear from the example given, and by their use we are enabled to greatly simplify many calculations which would otherwise be very tedious.

There are two principal uses of the decibel:

1. To compare one sound intensity

to another. For instance, if the energy of one sound is one hundred times as great as another, we say that the first sound is 2 bels, or 20 decibels, greater than the second. Thus, if the output of an amplifier is 6 watts, while the input is .06 watt, a power ratio of $\frac{6}{.06}$ or 100 we say that the amplification, or "gain" of the amplifier, is 20 decibels.

2. To measure the absolute value of sound energy by comparing it to some generally accepted standard energy value, either implied or expressed.

For comparison purposes, acoustic experts usually refer sound intensities to "minimum audibility." Minimum audibility," or "threshold of hearing," as it is sometimes called, may be defined as the weakest sound which can be heard under absolutely quiet conditions. The power of such a weak sound is unbelievably small, being of the order of only ten thousand millionth of a microwatt (a microwatt is a millionth of a watt),—another indication of the sensitivity of the ear. Thus, when the acoustic engineer refers to a sound as having an intensity of 50 decibels, the statement is actually incomplete; it should be said that the intensity is "50 db. above minimum audibility," or "50 db. above threshold."

"Minimum audibility" is much too small to be used as a reference intensity for relatively loud sounds, such as those coming from the ordinary loudspeaker. Another reference intensity generally known as "zero level" has, therefore, been generally adopted by communication and sound engineers. An idea of the intensity of sound at "zero level" may be had if it is remembered that speech from a telephone receiver held tightly against the ear is about zero level when it is just too loud to be comfortable.

Engineers have agreed that, expressed in electrical power, this "zero level" should be taken as .006 watt. Thus, compared to "zero level" of .006 watt, the 6-watt output of the amplifier mentioned under (1) above would correspond to a power ratio of $\frac{6}{.006}$ or a ratio of 1,000. From the table it is seen that this ratio represents 30 decibels. Hence it is said that the output level of the amplifier is "30 decibels above zero level" or, simply, "30 decibels." Just as room temperature is commonly expressed as, say, "70 degrees" without specifying that it is "70 degrees *above zero*," sound engineers commonly refer to the output of an amplifier as being, say, "30 decibels" without specifying that they mean "30 decibels *above zero level*."

"Output Level" and "Gain"

Care should be taken not to confuse the "output level" of the amplifier with the "gain" of the amplifier referred to under (1) above. Each is commonly expressed in decibels, although, as explained, the output level should, strictly speaking, be expressed as "decibels above zero level." Thus, while the *output level* of this amplifier is 30 decibels (above zero level), its *gain* is only 20 decibels, as figured above. This will be more readily understood when it is considered that the input (.06 watt) is already 10 decibels above zero level. This is figured from the power ratio of $\frac{.06 \text{ watt}}{\text{zero level}}$ or $\frac{.06}{.006}$ or 10 which, from the table, corresponds to 10 decibels. If the input of 10 decibels above zero level is increased by the 20-decibel gain of the amplifier, the output level will, of course, be 30 decibels above zero level. This is also in accordance with what we said earlier about the addition and subtraction of decibels.

The table given below shows the approximate power ratios corresponding to from 1 to 30 decibels. There are two convenient relations to remember in dealing with decibels. The first of these is that ten decibels correspond *exactly* to a tenfold change in power. The second relation to be remembered is that in order to make a sound louder by 3 decibels it is necessary to approximately double its power. What this means can be more easily pictured when you consider that if the Niagara Falls power plant output were in the form of sound energy, it would be necessary to construct another power plant of the same capacity in order to increase the sound output by 3 decibels. In the same way for 6 decibels increase, the power would have to be about four times as great, for 9 decibels about eight times as great, and so on.

Power Ratios	Decibels
1.25	1
1.6	2
2.0	3
2.5	4
3.2	5
4.0	6
5.0	7
6.3	8
8.	9
10.	10
100.	20
1,000.	30

One cannot learn to drive an automobile by reading an instruction book. The same is true in studying the use of the decibel; it is necessary to actually apply the principles outlined to specific problems before they will be thoroughly understood. It is suggested, therefore, that the reader take advantage of any opportunities which may arise to make practical applications of the tables and explanations given. A little practice along these lines will convince him that the decibel is an extremely simple and useful unit.

Interesting Acoustic Problems Involved in Unique Outdoor Theatre Installation

SOME very interesting acoustic problems were involved in the recent installation by RCA Victor Co. of Photophone apparatus in the new Driv-In Theatre (open air) in Camden, N. J. The analysis of the problem involved included a study of the number and location of loudspeakers to give not only a uniform distribution or coverage of sound over the entire parking area but the proper illusion of sound as coming from the screen; also, a study of the amount of power or size of equipment required to give an adequate loudness of sound within the automobiles and to override the general noise level due to nearby auto traffic and wind.

Full low-frequency response for giving richness to music is doubly important in outdoor installations because the reverberation which usually builds up the low-frequency response of indoor installations is entirely absent outdoors. For this reason and because of its narrow distribution angle (33° arc) the directional baffle loudspeaker was chosen for the Drive-In Theatre.

The intensity of sound from a loudspeaker is greatest along its axis and the intensity diminishes for points removed from the axis, that is, for increasing azimuths. In the horizontal plane a uniform distribution of sound is obtained from three loudspeakers, because in passing across the field of sound from one loudspeaker axis to the next, the increasing intensity of the one compensates for the decreasing intensity of the other. In the vertical plane, a fairly uniform distribution of sound is obtained because the increasing intensity due to decreasing the distance from the loudspeaker compensates for the diminishing intensity due to the increasing azimuths.

The narrow distribution angle of the directional baffle loudspeaker is of particular benefit in outdoor installations in reducing the amount of power

A B C'S OF PHOTO-ELECTRICITY

A. J. McMaster

G-M LABORATORIES, INC.

ALTHOUGH some of the electrical effects of light on certain substances have been known for nearly one hundred years, it is only within the past decade that substantial and significant progress in the engineering application of light sensitive devices has taken place. In order that we may find a proper place for photo-electricity in the modern scheme of engineering practice, let us consider for a moment some of the many forms of engineering in which the primary objective is the transformation of one form of energy to another.

Thus, we have various forms of so-called electrical generators in which mechanical energy is converted to electrical energy. This process is readily reversible in transforming electrical to mechanical energy by means of motors, solenoids, etc. Again either mechanical or electrical energy may be changed to heat. Such processes are in some cases also reversible as evidenced by friction, electrical heating, the turbine, and thermo-electricity. Chemical energy may serve as a source of electrical power, and when we charge our automobile battery we again reverse the transformation process. One could name other examples of this universal effort to change one form of available energy to another, but sufficient mention has been made to establish the desirability of seeking engineering means for making all forms of energy interchangeable.

But we have not as yet considered one of the most abundant forms of energy, namely, that of light. Abundant not only in nature, it is of course produced artificially on a tremendous scale. The utilization of solar energy goes on everywhere about us, but not in a direct and readily controllable manner. It is not the purpose of this paper to suggest a photo-electric method for the direct transformation of the sun's energy. This process, though possible, is yet too inefficient to be of the least economic value. However, we shall direct our attention briefly to the devices available for the utilization of light energy for measurement and control purposes.

Types of Cells

Photo-electricity has been defined as any electrical effect produced by the action of light. Three fundamental types of light sensitive phenomena will be considered briefly herein. The photo-emissive effect, though not the oldest, is perhaps the most common. The term "photo-electric cell" is generally used to designate a cell or tube in which electrons are emitted under the influence of electro-magnetic radiation—usually visible, ultraviolet, or infra-red radiation. The photo conductive effect refers to devices in which light produces a change in electrical conductance. Such devices are known as photo-conductive cells of which the most common example is the selenium cell. The third classification is that of photo-voltaic cells of which there are the so-called electrolytic and electronic types. Such cells require no external source of voltage and have relatively low internal resistance.

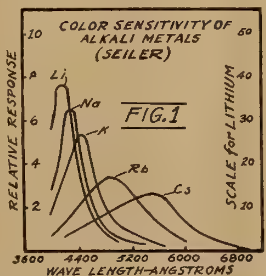
Photo-emissive cells have been made with many different types of sensitive surfaces. For use in the visible spectrum most cells have a surface of a pure or compounded alkali metal. Such surfaces must be prepared and maintained in a vacuum or an atmosphere of inert gas at low pressure. The cells generally take the form of a glass envelope within which the sensitive cathode is either deposited on the inner wall of the bulb or on a suitable plate structure. The anode is usually of considerably smaller area than the cathode and may take the form of a wire or ring which serves to collect the electron emission from the cathode.

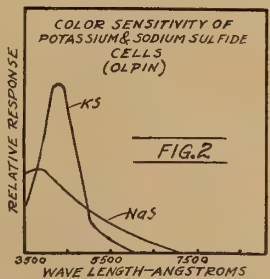
If the finished cell is highly evacuated, it is known as a vacuum cell, in which the photo-electrons are the only current carriers. If the cell is filled with an inert gas at low pressure it is called a gas-filled cell, in which the primary electrons ionize the gas, resulting in a total photo-electric current of from one to 50 times as great as that in a similar vacuum cell.

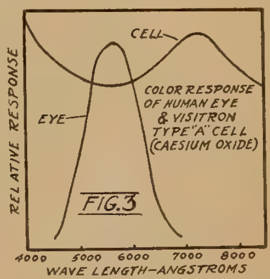
Photo-Emissive Characteristics

Some of the principle characteristics of photo-emissive cells are shown in Figures 1 to 8. In Fig. 1 the relative response of the various alkali metals to various wave-lengths of light is shown. It will be noted that all of the alkalis are sensitive in the visible spectrum which extends approximately from 4,000 to 8,000 Angstrom Units. The maxima of sensitivity are found farther toward the longer wave-lengths for increasing atomic weight of the alkali metals. Sodium and potassium are generally sensitized with hydrogen, which process shifts the maxima of these two alkalis slightly toward the red end. Tungsten incandescent lamps are generally used as light sources with photo-electric cells. The distribution of energy from a tungsten filament operated at 5000° K is shown in Fig. 4. Because this source emits most of its energy in the red and infra-red, it has been desirable to produce photo-electric cells which have greater sensitivity for long wave-lengths of light. Progress has been made in this direction at Bell Telephone Laboratories as illustrated by the curves in Figure 2.

The most generally used cell today is that known as the $Cs\text{-}Cs_2O\text{-}Ag$, or more simply, the caesium-oxide type. The sensitive surface consists of a silver film or plate which is oxidized and upon which a carefuly controlled quan-



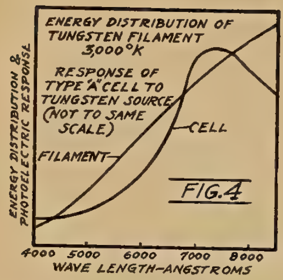


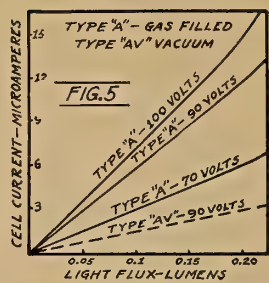


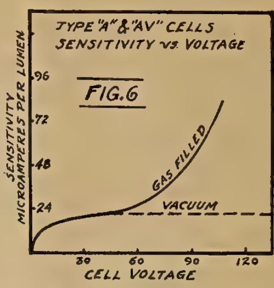
lost by radiation into the open air overhead.

Knowing the distribution characteristics and efficiency of a loudspeaker, and the sound pressure or acoustic power desired at any point in the sound field, it is possible to determine the electrical power required at the input of the loudspeaker. Calculations show that the power output or size of equipment varies directly with the area or number of seats to be covered. Such calculations show that for normal conditions of noise, the power output (40 watts), of the Photophone PG-32 equipment is ample for covering the listening area in the Driv-In Theatre.

The rugged construction of the dynamic cone driver in the directional baffle type of loudspeaker makes possible an unusually large power handling capacity and consequently a minimum number of loudspeakers. Three directional baffle loudspeakers are more than adequate for handling the output of the PG-32 equipment without distortion.



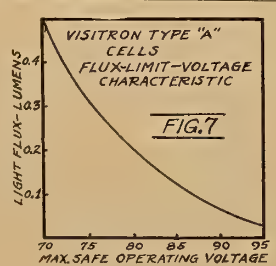


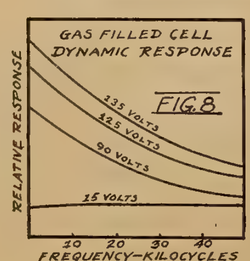


tity of metallic caesium is deposited. Caesium reacts with Ag_2O to form an oxide of caesium with which a very thin film of metallic caesium is associated. The process is one which requires considerable delicacy of control and manipulation but it results in cells which are many times more sensitive to red light than any heretofore produced.

A typical color sensitivity response curve of this cell is shown in Fig. 3. In the same figure is shown the color response of the human eye. In Fig. 4 is shown the response of the caesium oxide cell to the light from a tungsten filament.

Photo-emissive cells have a substantially linear current response with respect to incident light intensity as shown in Fig. 5. The output of gas-filled cells increases with applied voltage until the curve of Fig. 6 approaches a vertical line, at which point the ionization becomes self-sustaining and the cells glow. This generally reduces or destroys the sensitivity of the surface and should be avoided by maintaining the applied voltage below the maximum safe voltage given in Fig. 7. Vacuum cells, however, exhibit a saturation characteristic which is to be expected because of the absence of gas. Vacuum cells have roughly one-fifth the output of gas-filled cells but are more stable and are not critical with respect to operating voltage, as shown in Fig. 6.





The dynamic characteristics of a typical photo-emissive cell are shown in Fig. 8. A vacuum cell shows essentially uniform response over a wide range of frequencies. The gas-filled cell shows marked attenuation with increase of frequency. Furthermore, the greater the applied voltage (resulting in more gas amplification), the larger is the attenuation at high frequencies. As the frequency increases the dynamic output approaches that of a vacuum cell.

There are many other photo-emissive cells employing sensitive surfaces which are sensitive to ultraviolet light. Although their characteristics are interesting, their application at present is limited to scientific research and a very few semi-commercial applications.

[In the next issue Mr. McMaster will discuss photo-conductive and photo-voltaic cells.—*Editor.*]

PLAN SMALL TOWN INVASION WITH 16 MM. SOUND-ON-FILM EQUIPMENT

PLANS are under way to open up a vast new market for motion pictures by installing 16 mm. sound projection equipment in more than 5,000 towns which now have no picture exhibitions. Idea has already been sold to two major film companies (understood to be Fox and Paramount) to use their releases, both feature and short subjects, for reduction from 35 mm. to 16 mm., with distribution to be effected through regular booking tie-up with those who will buy the sub-standard equipment on the strength of guarantee that ample product will be available. Jack Barry, formerly head of Publix Managers School, understood to be originator and prime mover in plan.

It is estimated that about 5,000 towns of 3,000 population each are ripe prospects for this plan. Film distributors are expected to glean from $200,000 to $300,000 extra weekly, with approximately two years being added to the playing time of each subject. Churches, schools and small auditoriums are also being considered as likely spots for such equipment.

Equipment and Operation

Equipment and operating angles of the plan are of interest to projectionists. RCA is reported to be supplying the sponsors of the idea with complete projection and sound equipment. A 500-watt incandescent lamp used heretofore with this equipment will be supplanted by a 700-watt lamp. Sponsors insist that a good 12-foot picture is obtainable with the equipment, although other observers hold 9 feet to be the limit.

Shows run something over two hours, with projector reels having a capacity of more than 4,000 feet. So-called safety stock is used, which means the non-observance of all restrictions as to magazines and operating precautions which apply to nitro-cellulose stock. Reports received by this publication would indicate some measure of dissatisfaction with the "safety stock" on the score of deterioration after a couple runs, plus the common fault of difficulty in splicing. Sound is satisfactory, the frequency range encompassing from 150 to about 4,800 cycles.

Food for thought in this plan for both exhibitors and projectionists.

FEW STUDIO CHANGES FOR W.E. WIDE RANGE

As far as the studio is concerned, no drastic changes are necessary for W.E. Wide Range recordings. A studio that was considered a good studio for sound recordings previously, is still a good studio for Wide Range recording. The new equipment necessary to introduce Wide Range can be enumerated briefly as follows: a new lens system, an improved microphone, minor modifications of the amplifier system and new equalizers. To make the change-over effective throughout the studio, it is necessary to provide improved equipment also for the monitoring system and the review rooms.

The modifications of the studio equipment are not in themselves complicated. It is highly essential, however, that they should be fully and expertly applied and that the entire Wide Range recording installation should be thoroughly coordinated inasmuch as only a complete and harmonizing improvement of recording, monitoring and review rooms can result in the full attainment of quality.

NEW OMAHA ORDINANCE

Projectionists and exhibitors of Omaha, Neb., finally have agreed on a new city ordinance to govern licensing of projectionists. Plan passed by the city council provides for a board of examiners composed of a representative of the fire department, the city electrician and city building inspector. Former board also included one exhibitor and one projectionist. The new law will reduce the 60-day residence requirement to 30 days.

Observations . . .

WHAT the projectionist craft needs most of all, and that for which it displays the least aptitude, is efficient organization. Sectionalism is rampant within the craft, with one state unit neither hearing nor caring what happens in a neighboring state, despite the oft-demonstrated truth of the statement that occurences in, let us say, San Francisco projection circles, whether affecting wages or conditions, ultimately exert their influence on happenings in, for example, Boston.

This condition of disorganization is emphasized by the following item appearing in *Motion Picture Herald* for July 29:

> **Theatre-owning interests of Sheboygan, Wis., last week won a signal victory from its common council. In May was passed an ordinance requiring one operator for each projection machine, shooting overhead skyward. To the council theatre owners brought concrete proof, indisputably indicating the impossibility of films catching fire, causing serious damage. Repealed was the obnoxious ordinance, sad were projectionists, happy were theatre owners. . . .**

Of course, the "concrete proof" adduced by exhibitors in support of one-man projection shifts undoubtedly is hooey, and probably reflects only better organization on the part of exhibitors. This need not be discussed at this time. What interests us very much, however, is the fact that at one stroke projection crews are cut in half, organization strength and revenue are sharply reduced, and a bad precedent is set. More pressing is the question: "What shall we do about it?"

Two-men projection shifts agitation is the history of a small group of unselfish people within the craft who have worked long and hard in an effort to achieve coordinated action by scattered groups. Of late, two-men projection shifts activity is the history of the work of an individual, and that the writer of these lines. The result of this condition is apparent in the foregoing item relating to Sheboygan, Wisc. What is all this talk of leadership and organization? If the aforementioned result be the product of this much-discussed leadership and organization, then may projectionists everywhere pray fervently that they be spared such leadership.

Four months ago the Projection Advisory Council, prodded by its able and courageous president, Thad C. Barrows of Boston, undertook to strengthen the tottering structure of two-men projection shifts. From the Council membership was formed a committee to direct this work, and numbered among its personnel were such capable craftsmen as Thad C. Barrows, Lester Isaac, director of projection, Loew Theatres; Harry Rubin, Paramount-Publix director of projection, and M. D. O'Brien, assistant director of projection, Loew Theatres. Here was a group of men ready to go to work—at no salary—and in back of them were more than 3,000 other Council members ready to cooperate.

Funds were needed—hardly more than a producer might drop at a race track in an afternoon of bad guessing. An appeal for organization and individual backing was made. And then came the bombshell in the form of the question: "What's the use of fighting for two-men shifts just to put dual union members to work?". You don't believe it? Neither did we, at first. But it's true. But . . . four months later from the same quarter was released the sage observation that the salvation of the projectionist craft lay in a strenuous campaign for two-men projection shifts. We leave the balancing of this equation to better mathematicians than we are.

There is no ducking the fact that only projectionists will benefit through two-men shifts, but this in itself is hardly enough to justify non-cooperation by every member of an organization serving the theatrical field. Projectionists are not to blame if the introduction of sound pictures served to make theirs the dominant craft in the motion picture field, even though their ascension was marked by a correspondingly sharp decline in jobs for stagehands. The latter group at present are very badly situated, with few jobs available and in the face of a steadily increasing demand on the part of exhibitors that the matter of projectionist conditions be considered apart from the question of stage service and maintenance.

We agree wholeheartedly that two-men shifts are the salvation of the projectionist craft, but unless the latter takes immediate steps to safeguard this condition, without depending upon others and by foregoing petty politics, the curve of two-men operation will continue downward. Thousands of dollars are available for lawyers, good, bad and indifferent, to fight deposed labor "czars" and to sustain contracts which often are not worth the legal fee involved. Attacked "czars" usually are permitted to select their own lawyers, without haggling about costs. But not one penny is available to back up a fight to keep men working and that will mean double the pay at the end of the week. Unless projectionists themselves band together to sustain two-men shifts, without waiting for others to help them, there will be nothing much left for which to fight.

Incidentally, copies of that issue of I. P. in which appeared the address on two-men shifts by the undersigned before the legislatures of Connecticut and Ohio, are no longer available. However, a verbatim transcript of this address was printed in the June issue of the General Bulletin of the I. A., to which similar requests should be directed.

Labor and Public Relations

LABOR has never concerned itself unduly about its public relations. Newspaper accounts of the West Coast studio strike by I. A. units show very clearly the great need for increased favorable publicity for labor organizations. Consider a family man sitting at home after a hard day's work on a job which pays him the munificent salary of $18 a week for six full days. Upon reading the newspaper accounts of the Hollywood strike he might well remark to his wife and children: "I see where those union fellows who help make our movies are striking because they get only $100 a week". And make no mistake about this: it actually happens in thousands of homes—and the "family" mind reacts accordingly.

Even the hammiest eight-time-a-day actor has some sort of press contact; but not Labor. Why? Labor certainly needs the modern skilled press agent, whose work is much more specialized than any group of craftsmen affiliated with Labor.

Code Business

LAST month, in advance of clarifying opinions from directors of the National Recovery Act, we came out flatfooted and said: " . . . industry trade papers reflect a feverish activity on the part of industry groups to . . . agree upon a code. But, the industry press seems to have overlooked the obvious fact that the primary interest of the Act is the welfare of the laboring class."

(*Continued at foot of next page*)

HOW TO JUDGE SOUND PICTURE RECORDING QUALITY

Charles Felstead

IT IS a difficult matter for persons not actively engaged in sound picture work to judge a production from the standpoint of sound quality with a reasonable degree of accuracy in indicating where fault, if any, exists in the recording. Yet, with a little training in sound evaluation, with some knowledge of the characteristics that make recorded sound poor or good, it becomes fairly easy to judge the relative merits of any example of sound recording, regardless of the types of sound recording and reproducing equipment and the recording medium employed.

It must of course be known that the fidelity of the reproducing equipment used is as good as the average; otherwise loss of quality due to the reproducing equipment would be attributed to the original recording. Where it is desired merely to make a comparison of quality between two sound tracks that run in sequence on the same projection equipment, the fidelity of the equipment is not a material factor. But to evaluate a single sound record for its individual characteristics requires that the reproducing equipment be as good as possible. The following short cut in judging sound quality is based on the assumption that the reproducing equipment employed has at least average fidelity.

Sound Quality Evaluation

The following form is supplied to Academy members for making personal memoranda at the annual exhibition of pictures for the purpose of granting the Sound Recording Award. Since all phases of recording must be considered, the form is necessarily rather elaborate. Even so, it requires but a minute to fill it in:

1. **Production:** ....
   Studio: ....
2. **Sound Character:**
   Dialogue: Clear........ **Rounded**........ **Muffled**........ **Distorted**........ **Music: Clear**........ **Rounded**........ **Muffled**........ **Distorted**........
3. **Articulation: Excellent**........ **Fair**........ **Poor**........
4. **Sound Quality: Harsh**........ **Smooth**........ **Dull**........
5. **Sets: Live**........ **Average**........ **Dead**........
6. **Acoustic Perspective: Excellent**........ **Fair**........ **Poor**........
7. **Frequency Characteristic:**
   Highs: ....
   Lows: ....
8. **Ground Noise: Loud**........ **Medium**........ **Low**........
9. **Remarks:** ....

In making this record of sound quality, check marks are employed wherever possible to simplify the work. The names of the production and the studio at which it was made are entered at 1 in the form. In recording the sound character, the quality of the dialogue and music in the sound track are indicated by check marks. The meanings of the terms *clear* and *rounded* should be evident; and by *muffled* is meant speech or music which sounds as though it were spoken into a barrel. It is different from *distortion,* which is usually due

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Observations . . .

Subsequent developments confirmed this viewpoint. The essence of the NIRA is compulsory observance of a spread of employment and a minimum wage. A "minimum wage" does not mean the only wage, however, as wages over and above the minimum requirements of a given code still remain a matter for "collective bargaining" between employer and employee. A code for the legitimate theatre has already been submitted, and practically unanimous agreement was obtained to maintain stagehands' pay at the rate prevailing on July 1. All contracts will continue in force.

The motion picture code, in which projectionists will be included, undoubtedly will approve existing projectionist wage scales. The only possible fight will concern the number of projectionists on a shift—our old friend, the two-men question popping up again. As an organization, projectionists have done nothing by way of preparing for such a battle, and they have no foundation upon which to rest their contentions. Such efforts would be extending aid to dual unions, don't you know? However, thanks to certain individuals, to whom the buck was passed by those who followed a policy of looking wise and doing nothing, much valuable information on this point is available.

Permit Men Status

THE New York Supreme Court decision relative to the effort of 327 permit men to gain full membership in Local 306 (reprinted verbatim in this issue) while favorable to the Local, does not settle this vexing question. Next month, or six months from now, or a year from now another group of permit men will begin a similar action elsewhere, with ultimate success practically assured. It is one thing to stand upon the "rights" of organized labor to control conditions of membership; but it is something else again to be sure that organized labor will always be judged on a strictly legalistic basis. Labor will be wisely advised indeed if it comes speedily to the conclusion that permit men cannot forever be bound by the restrictions now imposed upon them. The payment of per capita tax on permit men, considered a smart move when legislated at Columbus, comes pretty close to being taxation without representation in that it constitutes payment for "privileges" as yet undetermined and certainly not enjoyed by permit men. Buck-passing will not suffice longer to keep this situation under control.

These remarks should not be construed as urging favorable action toward permit men; but they do constitute a plea for decisive action one way or the other before the privilege of deciding is usurped by the courts.

James J. Finn.

to infidelity in the recording apparatus. Check marks are likewise employed in place of written notations in filling in section 3, 4, 5, 6, and 8.

In section 3, the average *articulation* of the speakers in the picture is used as the basis for judgment. Poorness here would not be altogether the fault of the recording engineers but would depend to a considerable extent on the quality of the actors' voices. The *sound quality* tells more about the grade of the sound than almost any other entry in the form, and so the check in this section should be made with care. *Smooth* quality is the most desirable condition, of course, and is an indication of careful recording and "dubbing" on the part of the recording engineers. Poor recording can sometimes be smoothed up by skillful dubbing; but since this chart represents only an evaluation of the quality of the final sound that finds its way into release prints, it is immaterial whether the original sound quality was smooth or harsh, or whether it was altered in the dubbing process.

The characteristics of the *sets* that were employed in the making of the production may be determined by the amount of reverberation that is present in the recorded sound. If the walls of the sets were "hard," that is, were made of some hard material such as wood, and the monitoring carefully done, there would be *average* reverberation present in the sound, which is the most satisfactory condition. If the walls were so constructed and of such materials as to cause extreme reverberation, the sets would be classed as *live*. A *dead* set is one in which there is little or no reverberation.

Acoustic Perspective

The handling of the *acoustic perspective* is a measure of the experience and skill of the recording engineer. The acoustic perspective refers to the relationship existing between picture and recorded sound, and is governed by the placing of the camera and the microphone for each scene. It is *excellent* when the voice of the speaker is of the proper loudness for the position of the speaker's image on the screen. Then the voice will be loud during a close-up scene and less loud during a long-shot. It is poor when the sound of the voice does not match the picture of the speaker and seems to come from a different part of the set than the point at which the speaker is located. Securing just the proper amount of reverberation when recording each scene is a vital factor in creating the correct illusion of acoustic perspective.

Under *frequency characteristic* it is desirable to indicate whether there was an overemphasis or lack of high-frequency (high-pitched) or low-frequency (low-pitched) sounds in the recorded dialogue and music. Unsatisfactory balance of "highs" and "lows" in sound recording results in unnatural sound; and is usually the result of inferior recording equipment or the unskilled handling of good equipment.

Ground noise is the amount of rush noise, popping, sputtering and other extraneous sound present in the reproduction of the sound record. Much of this noise is the result of inherent characteristics in the recording medium, which is either a composition record or motion picture film. *Loud* surface noise is very objectionable, and where it is not due to the reproducing equipment, it is a black mark against the recording engineers. Any sound characteristic not covered in this form may be entered under *remarks*.

These outlines when completed form a valuable study of the class of recording done at the various studios and the quality of the sound accompanying any particular production covered by the outlines. For extensive use, they should be printed forms perforated to fit a standard ring binder. They may be filed alphabetically by production or studio, depending on whether the sound quality of individual productions or the quality secured by a particular studio is of the greater interest.

Filling in this outline when attending the theatre provides valuable training for the student and priceless information for the sound engineer.

PRACTICAL PROJECTION PROBLEMS

(*Continued from page* 15)

a photo-electric cell, ample light, and electricity. Perhaps some photoelectric cell method for automatic change-over can be devised that will eliminate the change-over marks; or at least, incorporate them in the film in some way, so that the projectionists won't have to watch for them.

The density of the film should be such as to suit the requirements of the average theatre, according to the illumination provided. We now receive many prints that are satisfactory in the big theatres where the intensity of the light source is sufficient; but they are far from being satisfactory in the smaller houses of the country. In order to determine the proper density to which the films should be printed, they should be viewed in the screening room at about the same brightness they will have in the theatres.

"Automatic" Change-Overs

Mr. Finn: The pattern of the travel-ghost target was designed with the definite idea in mind that it must be seen from the projection room. It would be very difficult to see from the projection room a pattern like the one Mr. Kurlander suggested. If travel-ghost is eliminated to the extent possible with this target, there will be an enormous improvement in projection.

As for utilizing the photoelectric cell to actuate an automatic change-over, it is true that we have available every necessary component. But it occurs to me that whatever will actuate the photoelectric cell will have to be on the film itself. Although an automatic change-over device is very desirable, I do not believe that one rational idea has been proposed so far that would utilize a photoelectric cell for a change-over.

As for the optical alignment tool, the Committee emphasized the fact that it is not a new device, but that like so many other things that are proposed, it finds its way into the library, and that is the end of it. Although this tool was used in the days of the tungsten lamp, it is not being used now. True, the tool is a machine job; if it is to be used in the projection room, it will have to be bought.

Mr. Edwards: Anybody who has operated a projector for any length of time has found out very early that it was impossible to eliminate travel-ghost while looking at a picture. The old way of doing it was the way it is done today—to wait for the title—because the title contains horizontal lines, vertical lines, and points, by means of which one can detect the travel-ghost. Unfortunately, in sound pictures there is not very much in the way of titles.

Alternate bars of black and white will, it is true, show the travel-ghost fringe; but that fringing will be three times as hard to detect on a bar pattern as on a point pattern, because on the point pattern one sees the stream of light coming right up to the points.

As for the change-over marks, I think every projectionist has had this experience when starting a projector, that just at the time when his eyes should be glued to the screen, something happens that diverts his attention for an instant, with the result that the mark slips past. The other mark comes along a little later, and he starts his machine at the change-over mark. I think the idea of having the start-machine mark in the shape of a diamond, and a change-over mark in the shape of a circle, will prevent many cases of that kind. The projectionist would know at once what the mark was for when he saw it.

As for the automatic change-over,

such schemes would be workable if every theatre always ran first-run film. The number of theatres that run first-run film are a small minority. But what will happen in the theatre that receives 30 or 60 or 90-day films, and sometimes 200-day films, in which case one is particularly lucky if he has the last scene in at all. How will the actuating device for the photoelectric cell work then?

So many different kinds of marks appear on film that it would be almost impossible to place a mark that would not be duplicated several times throughout the run of the film by accidental marks made by faulty equipment.

MR. KURLANDER: The value of the travel-ghost pattern rests on the fact that when no travel-ghost is present, a pattern is seen; and if travel-ghost is present the pattern is thereby changed. It is true that the projection distance will determine what the width of those lines should be. That is a point the Committee should investigate. The pattern, however, was advanced with the idea of detecting a very small change or increase in travel-ghost.

With respect to photoelectric cells, Mr. O. H. Caldwell, in a paper presented on the first day of this convention, certainly gave enough illustrations of the work that can be done by small photoelectric cells.

MR. FINN: I am very familiar with Mr. Caldwell's paper. I still maintain, however, that the fact that a photoelectric cell, or a light-sensitive cell, will operate a relay and cause a garage door to open doesn't mean that it is suitable for change-over purposes. A photoelectric cell must have some actuating means; and I insist that the film travel controls the change-over process. A mark is required on the film itself. What else is going to control the cell's operation?

MR. SCHLANGER: Some of the same films as, or films similar to, those used for testing projection equipment, could be advantageously used by the exhibitor to test the particular view of the screen that each seat in the theatre may afford.

Distortion Measurement

A simple device could be used in conjunction with the test films. It would consist of a piece of glass or other transparent material, small enough to hold in the hand before the eyes. On it would be printed a pattern, similar to the pattern used in the test films, consisting of a series of horizontal lines in one case, and vertical lines in another. By looking through this glass frame at the test film projected on the screen, the amount of distortion of the screen image from any seat in a theatre could be measured.

Such a testing method is intended chiefly for use in existing theatres having seating arrangements in need of correction to obtain a proper view of the screen. If such a device accompanied the test films distributed to exhibitors, and should the exhibitors themselves witness the distortion of the screen image as seen from the poor seats, they might show more interest in improving the sight lines of their theatres.

MEMBER: The accuracy or value of the optical alignment tool depends entirley upon the straightness of the rods. I wonder whether they might not become bent during use without being noticed; and whether a certain degree of springing might not occur—so that when the test is made, it might be thought that the system is faulty, when it isn't.

I would suggest the use of tubes instead of rods, with the idea that one might sight through the tubes and correct the alignment that way. If the tubes were bent, it would be noticeable. And I believe also that by that method it should be possible to make the alignment with only one setting instead of two, as are necessary in the case of a rod. A light would be placed at the end of the tube in the projection head and one would sight through the tube in the lamp house.

MR. RUBIN: This tool is made of steel that can't be bent without great difficulty.

MR. KROESEN: Many tests should be made before the rod is finally adopted, because there are too many variances throughout the projector mechanism to warrant our saying it is accurate without testing it sufficiently. Many manufacturing tolerances should be taken into consideration.

MR. JONES: The manufacturers of projector lenses certainly have during the past years given the subject of testing those lenses a great deal of careful study. I am quite sure that they have worked out tests that have proved satisfactory for detecting the various kinds of aberration; and I am wondering whether they have been consulted with regard to the various test objects that are adapted to show with the maximum of magnification these various defects that we wish to locate. If not, I certainly think that before we decide to adopt any particular test film, the matter should be discussed with them.

The Committee Viewpoint

MR. RUBIN: The purpose of the Committee has been to design or suggest, a set of tools for the projectionist that would be simple and easy to use, without requiring the assistance of specially trained engineers. Up to the present time, the projectionist has not been provided with any tools with which to test his equipment. He has not been encouraged by any society, to provide himself with such tools. The Projection Practice Committee has attempted to do so.

The tools—the test film and the alignment tool—have been so designed as to require no special training on the part of those who use them, to require a minimum of time in which to conduct the tests, and to require no additional equipment whatever. Perhaps these tools can be improved; I am sure that the optical companies have better testing equipment, but it is probably more elaborate.

For many years projectionists used titles for testing for travel-ghost. Since the inception of sound and the absence of titles, he has had to substitute something for the title, and has found that any vertical sharp point against a black background, or a white spot against a black background, will be the best test for travel-ghost.

In the present design the sharp points against the black background are easily visible, and provide the best means for accurately correcting the travel-ghost. Both fine lines and heavy lines are provided, and you will notice that the sharp lines show the travel-ghost

much better than the other lines; and furthermore, until such time as means are developed that will make it unnecessary for the projectionist to use spy glasses or to go within 20 feet of the screen, we shall have to do the best we can with the system that we have.

MR. KURLANDER: The reason, I think, why titles were so effective in showing up travel-ghost was simply that the titles approximate horizontal lines and were small in comparison with the travel-ghost. Not much travel-ghost is needed to show in a title. But in the proposed test target, the figure is large, and one can not see much travel-ghost in a figure of that size.

With respect to the alignment tool, it is very difficult to induce projectionists to use tools of any kind in aligning their equipment. A similar tool was tried years ago and a few conscientious projectionists used it. But the larger number of projectionists didn't care and they did not use it; that is why the tool went out of use. I doubt whether such a tool will find extensive use.

MEMBER: Has anyone looked into the possibility of designing some device for adjusting the optical system?

MR. RUBIN: This Committee has been endeavoring to obtain the cooperation of the manufacturers in designing such tools, but up to the present we have had no such cooperation. The Committee would be very happy to have the cooperation of every manufacturer. With the help of the RCA Victor Co. we were able to prepare the test reel that you saw today. We have in mind a number of other tools and have invited many manufacturers to cooperate in the work. I am sure from this discussion here today that something will be done.

MEMBER: Why should the device for testing equipment exist separately from the equipment itself? There is a possibility that the operator will pay no attention to a separate piece of equipment, whereas if the equipment is made part of the main apparatus he may be induced to look at it occasionally.

MR. RUBIN: The lens manufacturer may have a little gadget for his lens, but what about the mechanism, and the sound head, and the condensers, and the lamp, and other elements that go with it?

MEMBER: Are there no graduations on those things to show when they are correctly aligned? Couldnt they be extended?

MR. RUBIN: Probably they could. But this Committee is working with material already in the theaters; we must obtain the best results with the equipment that is in the field.

Present Equipment Considered

DR. GOLDSMITH: The point that has just been brought out is well taken. There are two ways of determining the momentary condition of a piece of equipment. One is by means of some

indicator, which is an integral part of the device itself, as, for example, a voltmeter or an ammeter or some mechanical indicator which shows the instantaneous condition. The second method is by means of a separate adjunct that can be brought by a service man to the location of the device.

The difficulty is that we face a condition where something over 10,000 theaters in the United States have actual projection equipment in their projection room and, economic conditions being what they are, it will be some time before most of these projectors are replaced. When they are replaced, certainly the projector manufacturers would be well advised to consider the inclusion of self-contained indicators wherever practicable.

Certainly the rod-type centering mechanism that has been described could hardly be included in the projector, because it would occupy space to the exclusion of the carbons, the film, and the lens. It is, therefore, a device that apparently could not be permanently in place. But certain other things might well be included in the projector, such as mechanical gauges or sighting devices. Even if nothing else is accomplished by these suggestions except that we direct the attention of the projector manufacturers to these points, the discussion will have been of value.

Facing the conditions that it did, the best that the Projection Practice Committee could do was to devise external and separate indicators and devices that could be carried into the projection room and used for tests, leaving until some later date recommendations for the production of new projectors that would enable these tests to be carried out without any further test equipment.

Mr. Golden: With regard to the alignment tool, I believe that it should be known that the entire Loew's circuit is now using such tools, which have been found to be very effective and helpful in aligning equipment.

As to the possible chances of getting the projectionist to use the tool, after all, the projectionist of today can not be compared with the projectionist of the early days. With the advent of sound, he was forced to use tools that he had never dreamed of. So, therefore, since he has been able to master and handle sound, why can't he, if shown that this tool is practicable, be able to help put on a better show. The projectionist, once shown that the tool will help him in his work, will use it.

Mr. Bliven: The entire procedure seems to me to represent good practice in projection work; but the only objection that I have to make is the possibility of fatiguing the eye in checking the definitions. Why not use a very light straw color instead of the pure whites?

Dr. Goldsmith: It was suggested that a gray glass be slipped before the

lens but the difficulty is that as soon as the sharp edge contrast is lost, the sensitiveness of the test goes down again.

MR. BLIVEN: May I suggest that the field of test film be limited, to cover specific points at a time. Probably a thousand-foot film would not be long enough for that or perhaps the cost of the films would be prohibitive.

DR. GOLDSMITH: The Committee had in mind using a vignette with one of the test subjects so that only a portion of the field would be shown, the rest of the field being dark; and letting the person watching the vignette travel around. But difficult production problems would be involved, and more elaborate research than was thought justified.

MEMBER: In the early days when the machine had to be taken apart and oiled and cleaned, the obvious way for the operator to adjust the shutters was to place a small flash-lamp in front of the projection lamp and project the beam on the film; and then to set the shutters so that it covered the lens as the pull-down started. In all the years that I used that scheme I never had to use a test object on the screen to see whether I had travel-ghost. Travel-ghost is caused by the shutters being cut of time, and the lens must be closed while the film is being pulled down. It is not difficult at all to set the shutter in the projection booth without using any test object whatever on the screen. I think it is going to be impracticable to use a long reel. If the tests were made on four-foot loops, each one stored in a can by itself, the required test could be selected whenever desired. There would be a number of such loops, one for definition, one for aberration, and another for travel-ghost, or whatever the defects happen to be; and one would select the particular four-foot loop needed, and run it for whatever time necessary to adjust the projector.

"PERMIT" MEN'S STATUS DEFINED BY COURT

(*Continued from page* 11)

plaintiffs against the defendants for a declaratory judgment determining the rights and legal relations of the parties hereto. The relief demanded in the complaint is as follows:

"1.—That the plaintiffs and each of them are entitled to membership in the defendant Local 306 and are likewise entitled to equal rights, benefits, advantages and privileges with those of the present members of the said defendant Local 306; and in connection therewith there shall be determined the amount of initiation fees and assessments deposited and turned over by each of the plaintiffs to the defendant Local 306 in excess of the initiation fees and assessments paid by members of Local 306 during a like period of time, which excess the plaintiffs shall be entitled to a refund thereof or credit therefor; or in the alternative:

"A.—That the sums of moneys that plaintiffs herein deposited and turned over as aforesaid to the defendant Local 306 shall be determined together with the interest accrued thereon in favor of the respective plaintiffs herein.

"B.—That the right, title and interest to such funds deposited and turned over by the plaintiffs to the defendant Local 306 vests in the plaintiffs."

"Permit Man" Agreement

At the commencement of the trial, the cases of five of the plaintiffs were submitted to the Court, it being the intention to submit those cases, which were deemed typical, for the decision of the Court, with stipulations affecting the remaining plaintiffs. Upon the completion of the trial of the cases of the five plaintiffs a motion was made to sever the action as to the remaining causes of action. The motion was denied by the Court and the action proceeded with the introduction of additional proof and additional stipulations. Although in this decision the cases of such five plaintiffs may be referred to, the disposition of their cases will relate to all of the 237 plaintiffs.

Stated generally, as relating to these

plaintiffs, the procedure was as follows: An application for membership, signed by the applicant, was filed with the Union. Subsequently "a permit man's agreement" was submitted to the applicant for signature at the time of the filing of the respective applications, and thereafter varying sums of money were paid by the applicant for which receipts were given by the Union from time to time. It is the claim of the defendants that in each instance of the sums so paid, $200.00 was retained by Local 306 as security to indemnify it in the event of any claims being made against it by theatre owners or others by reason of the negligence of such applicant during the course of his employment as a moving picture operator. The applicant was thereafter given a working permit, issued temporarily for a specific job only and revocable at any time without notice at the discretion of the proper officials of Local 306. This permit entitled the applicant to work in theatres under the jurisdiction of the Local.

For that privilege, in accordance with the terms of the permit men's agreement, the applicant agreed to pay a certain percentage of his weekly wages to the Union. The Union admits that such payments were made but claims that no dues, assessments, sick fund and death benefit contributions were ever paid by these permit men as required to be paid by the regular members of Local 306. The men for whom employment was thus provided came to be known as "permit men", although no provision for such classification is to be found in the Constitution and By-Laws of Local 306 or the Constitution and By-Laws of the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators of the United States and Canada. It is the contention of the defendants that the plaintiffs knew at all times their status to be that of permit men, that they did not enjoy the privileges accorded the regular members, and that they were not entitled to membership in Local 306 until the requirements of its Constitution and By-Laws and the Constitution and By-Laws of the International Alliance were complied with.

I. A. Membership Requirements

The defendant Local 306 is an unincorporated association, composed of more than seven persons having its principal place of business in the Borough of Manhattan, City and State of New York. Admission to membership therein is governed by its Constitution and By-Laws and the Constitution and By-Laws of the International Alliance, of which it is a subordinate local. Briefly, the following requirements are necessary for membership in the Local: After an applicant has filed his application in the proper form with the proper authorities and has successfully passed the prescribed examination he may become a member only after (1) his application is approved by the General Secretary-Treasurer of the International Alliance; (2) he is voted upon at a meeting of the Union and receives a favorable vote of more than two-thirds of the members present; (3) "he is obligated as a member"—that is, takes

the prescribed oath of fidelity to the organization.

It is undisputed that the applications of the plaintiffs herein were never approved by the General Secretary-Treasurer of the International Alliance, that they were never voted upon by Local 306, and that they never took the prescribed oath or obligation. Notwithstanding non-compliance with these requirements, it is the contention of the plaintiffs that because of the manner in which the Union dealt with them and because of the alleged representations, warranties, promises, and agreements of the Union and its officers, these requirements were waived. Among other things, it is alleged that the Union held plaintiffs out to the public as members thereof, permitted them to picket and to carry placards during strikes announcing that the carriers thereof were members of Local 306 and affiliated with the American Federation of Labor.

No Waiver of Requirements

Without reviewing at length the testimony on this aspect of the case and the alleged representations and promises, assuming the same to be true, I am of the opinion that the plaintiffs have failed to sustain the burden of truth as to any waiver by Local 306 or the International Alliance of the requirements above referred to prescribing the conditions under which members may be admitted to Local 306.

In the absence of such proof and in view of the fact that the necessary requirements for membership have not been complied with, irrespective of any views the Court may have as to the desirability of plaintiffs being accorded membership in the Union and the hardships which they claim a denial thereof may entail, the provisions of the Constitution and By-Laws above referred to are controlling and the Court is without power to declare plaintiffs members of Local 306.

In McKane v. Adams (123 N. Y. 609, 192), the Court, in discussing the rights of an individual to membership in any unincorporated association stated as follows:

"* * * The right to be a member is not conferred by any statute; nor is it derivable as in the case of an incorporate body. It is by reason of the action and of the assent of the members of the voluntary association that one becomes associated with them in the common undertaking, and not by any outside agency, or by the individual's action. Membership is a privilege, which may be accorded or withheld, and not a right, which can be gained independently and then in force."

In Branagan against Buckman, (67 Misc. 242, 247), the Court in discuss-

ing such membership held as follows:

> "Such membership is a privilege which the association may accord or withhold at its pleasure; and a Court of Equity has no jurisdiction to compel the admission of a person not regularly elected, even though, as in the case of a political organization or labor union, the arbitrary rejection of a candidate may prejudice his material interests."

In this connection, see also White against Brownell (2 Daly's 329, 337-8) and Polin against Kaplan (257 N. Y. 277, 281-2).

No Assessment Refund

With reference to the alternative relief demanded the plaintiffs urge that should the Court deny their application for membership in Local 306, they are entitled to a return of all of the initiation fees, security deposits and assessments paid by them. As to the weekly assessments, the evidence convinces me that the plaintiffs at all times knew their status to be that of "permit men", that they knew they were not accorded the same rights and privileges as regular members because of such status, and that they paid their weekly assessments under their "permit men's agreement", for the privilege of securing employment under Union auspices, which they could not otherwise obtain. Several of the plaintiffs freely admitted that they had been employed as "permit men" for a number of years and are still employed without interference from the Union. Plaintiffs are not, therefore, entitled to a return of such assessments.

As to the sums of money paid by way of initiation fees and security deposits, a different situation arises. Since the change in administration in Local 306 was effected, the International Alliance has adopted a resolution abolishing the classification of "permit men" and the plaintiffs are now designated as apprentices.[1] Plaintiffs have applications for membership ending for varying periods in Local 306 which have not been acted upon by that body. In equity and good conscience, the Court directs that before any new members are admitted to Local 306 the applications of these plaintiffs should be disposed of in the following manner:

Fees, Deposits, Admissions

(1).—Such plaintiffs as do not desire their applications for membership to be acted upon by Local 306 may withdraw the same and thereupon receive from such Local all payments on account of initiation fees and security deposits less any offsets by way of claims against the deposits or unpaid assessments;

(2).—Such plaintiffs as do not desire to withdraw their applications for membership are entitled upon compliance with the requirements as to initiation fees and deposits, to have the same acted upon by the Local before any new members are admitted thereto. In the event of unfavorable action thereon, they are entitled to a return of all moneys deposited by way of initiation fees and security deposits, less any offsets by way of claims against such security deposits or unpaid assessments.

The judgment to be submitted herein should contain a provision restraining and enjoining the defendants, their officers, agents, servants and members, from accepting into the membership of Local 306 any new members thereof or designating any additional apprentices thereof until the applications of the plaintiffs have been acted upon as above indicated. The judgment should further provide that the defendants, their officers, agents, servants and members be enjoined and restrained from withdrawing or removing any funds deposited to the account of the defendant Local 306 or any other account, for and in behalf of or in trust for plaintiffs herein, until such time as the applications of these plaintiffs have been disposed of and acted upon as above indicated. Except as herein indicated, the injunction *pendente lite* heretofore granted is hereby vacated. Submit judgment and findings on notice in accordance herewith.

Dated July 11, 1933.

[[1]Note: This statement is in error, of course, as legislation abolishing the "permit man" status was passed at the I. A. General Convention in Columbus in June, 1932, and Harry Sherman did not assume office as president of Local 306 until February 11, 1933.—Editor.]

International PROJECTIONIST

Edited by James J. Finn

In This Issue:

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The IP EDITORIAL PAGE

Vol. 5, No. 6 SEPTEMBER 1933

Projection Work at Low Quality Level

Projection today in practically every theatre outside the "de-luxe" class might be described succinctly by the inelegant term "lousy." We believe that we have hit upon the reason for this noticeable falling off in the quality of picture delivered to the screen, a reason that has two roots; (1) penny-pinching on badly needed projector parts and other accessories, and (2) a drastically lowered morale on the part of projectionists, the result of wage cuts and less favorable working conditions. The prevelancy of a "don't-give-a-damn" attitude among projectionists today is truly amazing, and in justice to many projectionists it should be stated that they merely take their cues in this respect from owners and managers.

Projectionists are prone to forget that the job of holding up projection standards is exclusively theirs. Managers and owners know very little about projection, and unless the projectionist continually "rides" them on the matter of conditions and maintenance, projection will continue steadily to lose ground, the prestige of the art will suffer and, most important, the post of projectionist will become less valuable in terms of wages. Given an acceptable (not too good, but just acceptable), picture on his screen, the average manager is not going to worry too much about projection standards. But with an alert projectionist on the job and constantly demanding the co-operation of the theatre in the matter of proper maintenance, Mr. Manager cannot help but be impressed—even while he pooh-poohs the suggestions.

We are quite willing to place this matter on a purely selfish basis: a projectionist should exert every effort to maintain high quality projection, not necessarily because he loves his industry or has the natural desire of a craftsman to deliver good work, but merely because by insisting upon quality work he will be enhancing his own importance and helping to protect his wage. Think it over.

Building Craft Morale

Seldom indeed is it that we give any of our advertisers a pat on the back, our contention being that they should speak for themselves—at space rates. However, a couple promotional jobs put over recently by two companies in this field merit attention. First, is the campaign being waged by International Projector Corp. on the repair and replacement of projector parts. Thousands of dollars have been spent by this company to enlist the support of projectionists for higher projection standards. Naturally, it is hoped to spur the sales of replacement parts; but no projectionist should forget that in aiding in raising the standard of projection, the International Projector Corp. actually is helping to make the projectionist himself a more important cog in the theatre and is paving the way for the maintenance of conditions and wages.

Frequently one hears projectionists complain that they are not respected in the industry; and our answer is that projectionists cannot reasonably expect respect until they respect themselves and their work. One way to command respect is to take one's job seriously, to deliver quality work and to insist upon good equipment. A projectionist who will get along with old or worn equipment will measure up in the eyes of the boss to pretty nearly the level of the equipment with which he works. On the other hand, one who is constantly "beefing" about repair and replacement and who takes the trouble to point out the results of defective equipment cannot help but enlist the interest of his boss in quality work. We have often said that the boss was inoculated with his don't-give-a-damn attitude toward projection by his projectionist. International Projector Corp. may be said to have a selfish interest in maintaining projection standards, but it cannot be denied that the benefits therefrom are split pretty evenly with projectionists—and at no cost.

The other company winning our approval for aggressive merchandising of equipment is RCA Victor Co., which has just issued a beautiful series of selling aids for the exhibitor on its High Fidelity sound equipment. Good copy, banners, mats, display cards and other live selling matter is being supplied gratis to theatres using High Fidelity equipments, in an effort to impress the patrons' minds with the fact that theatres are sparing no expense to give the best show value. Here again Mr. Projectionist cashes in on the enterprise of a commercial organization which is spending much money to make the public quality-conscious. Projectionists should keep in mind those companies who are working hard to improve conditions and spur attendance, the source of all projectionist salaries.

More Light and Less Definition

We are almost ready to write a note of surrender to F. H. Richardson and admit that he was perfectly right in ranting against the devastating effect of porous and perforated screens upon visual projection. The cry all along has been, "Give us more light!"—and some lens manufacturers lost no time in answering that cry. The result has been a satisfying increase in illumination and a correspondingly sharp decrease in definition. It is easy to understand the desire for ample light, because every projectionist feels that a poorly-lighted screen image is a direct reflection upon his craftsmanship. And so it is.

It is known by every projectionist, however, that the first requirement of a good lens is not its light-transmission quality but the definition it gives. As between a small light loss and good definition, and the opposite condition, we should vote for No. 1 without a moment's hesitation. It is a matter for much surprise, therefore, to find that many projectionists are ignoring a known requirement and a cardinal principle of good projection work in selecting a lens first for its light-transmission quality and then for its definition quality.

Porous and perforated screens are to blame for this condition, as Richardson correctly points out, but even with the use of such screens it is desirable that definition be given first consideration. One can tolerate a picture which is not so brilliantly lighted; but a picture which is not sharply defined might just as well not be shown.

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MONTHLY CHAT

ONE month from the time these lines are written the shouting incident (inevitable, we might have said) to the formulation of a code for the motion picture industry will all be over. Wages and conditions for projectionists will have been adopted, and we are more concerned about the latter than the former. Projectionists need not contemplate a life of ease under the protective wing of a favorable code ruling, for the old, old fight for improved work must go on—code or no code.

It's funny how very much less trouble there is in localities where projectionists know their business ever so much better than their "opposition." There just must be something more to this matter than mere coincidence.

REFLECTING the keen interest of the field in the possibilities of an "automatic" change-over device are several letters from inventors who unashamedly admit that they have developed the "last word" in such a contrivance. Fine . . . only we might add that Mr. George Edwards, formerly editor of *American Projectionist* (alov-a-sholem), has promised for our next issue an article which will attempt to prove that the change-over process is now sufficiently mechanized to satisfy all concerned. This ought to be good—for not less than 63,457 humans (including exhibitors), have written the "last word" in the history of "automatic" change-overs.

THE current I. A.—I. B. E. W. jurisdictional controversy, which the latter group fervently prays may result in the ousting of I. A. members from projection rooms, tempts us to apply to projection room work a paraphrase of an old adage: one per cent electrical and ninety-nine per cent endurance. More about this matter in serious vein within.

W. G. WOODS, enterprising Secretary of the San Francisco projectionists and an ardent proponent of and hard worker for a craft organization, writes: ". . . What a glorious opportunity we have missed in not having a craft society, what with the NRA program and the Canadian Research Council report. A permanent and militant organization could have made fine capital out of these two activities. Those of us who worked hard for the plan at the time knew what we were after, but couldn't put it over. What a chance we have missed!"

To which one can only answer: "You're telling me?"


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INTERNATIONAL PROJECTIONIST

VOLUME V NUMBER 6

SEPTEMBER 1933

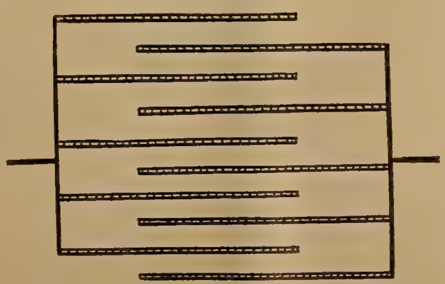
STRUCTURE AND FUNCTION OF ELECTRICAL CONDENSERS

Aaron Nadell

THE most important practical fact about the electrical condenser is best explained by making a misstatement. The misstatement is that alternating current flows through a condenser, although direct current does not. If a condenser and a lamp bulb are connected in series with each other and supplied from an A.C. line, the lamp will light. This would seem to indicate that the condenser provides a conducting path for the alternating current. Actually, what happens is more complex. But at this point it may be said that if the same experiment is repeated with D.C., the lamp will not light.

In effect, therefore, although not in fact, the condenser is the reverse of a rectifier. A rectifier permits only direct current to flow through it. The effect of the action of the condenser is as if only alternating current passed through it.

The simplest possible condenser consists of two sheets of metal fastened to opposite sides of a plate of glass. The reader may, if he wishes to experiment, build himself a condenser of this kind. He will find that a small light bulb placed in series with it will glow or light when alternating current is applied. If he makes a second condenser just like the first, and wires the two in parallel, he will find the illumination of the bulb increased. In other words, the condenser "conducts" alternating current, but not too well; it acts, in an alternating circuit, like a resistor. When resistors are connected in parallel the effective resistance of the circuit is decreased.



Condenser, built of alternate plates of glass and metal, connected in two parallel sets

Conversely, if the additional condenser is wired in series with the first, the light will dim down or go out; the effective resistance of the circuit having been increased, exactly as if condensers were resistors.

But it is plain that the condenser in an alternating circuit does not actually conduct current. Electricity cannot flow through the glass separating the two plates. One of the differences between the action of a resistor and that of a condenser in an alternating line can be shown by connecting a condenser in series with a pair of headphones and listening to alternating current of different frequencies. The loud speaker current of a sound system will serve for this purpose. It will be found that the high frequencies pass through the condenser more easily than do the low ones. This is not true of an ordinary resistor. A resistor of the carbon type will pass all frequencies equally well; a wire-wound resistor will tend to favor the lows—not because of its resistance

but because of the inductive effect of the coil winding.

Condenser Capacitance

If condensers are wired in parallel, increased current (alternating current only, of course), flows "through" them. The same effect can be produced by increasing the surface area of the plates. If the glass plate is removed and a thinner piece of glass substituted (bringing the metals closer together), the light of the bulb will also increase. Still another influence upon the capacitance of the condenser is the nature of the insulating material. This is most easily shown by removing the glass and separating the plates by means of insulating washers, so that the chief matter between them is air. If plates so spaced are mounted in a box, and the box is filled with castor oil, the illumination of the lamp will increase sharply.

Several types of condenser are now in commercial use. One consists of two plates of thin, flexible metal foil, insulated from each other by a strip of paper impregnated with wax. This arrangement is wound up to form a flat coil, thus securing plates of large area in a condenser of very small size. The thickness of the insulating paper will depend upon the voltage the condenser is expected to withstand. In order to secure the maximum capacitance the paper is made as thin as is consistent with safety, and the voltage that can safely be applied to the condenser is often printed upon the case or the wrapping.

Another common type of commercial condenser consists of many alternate plates of metal and mica (or paper). Plates 1, 3, 5, and so on, are wired together; so are plates 2, 4, 6, etc. The result is that of many small condensers connected in parallel.

The Electrolytic Type

A newer type, very efficient for certain purposes, is the electrolytic condenser. The insulating layer here is so thin it cannot be measured, but is estimated at far less than one one-millionth of an inch. It is electroplated on a metal surface, usually aluminum. The two conducting plates of the condenser are the metal and the electroplating solution. The film of insulation separating them is so thin that the capacitance of a small condenser of this kind is comparatively very high. The non-conducting layer, in spite of its thinness, possesses good electrical resistance, and condensers of this type can be made to withstand several hundred volts. They cannot, however, be used in all circuits, but only in those carrying D.C.

The electrolytic condenser must be "poled" correctly—the aluminum is always positive and the liquid always negative. If this polarity is reversed, the electroplating action is reversed also and the insulating film disappears, resulting in a short-circuit. These condensers are used as filters, in which relation they act as if alternating current passed through them, though in fact, as will be seen in a moment, that cannot happen.

The theory of the action of the condenser is a trifle complicated, and of little practical importance to the projectionist. Briefly, electricity is stored, or accumulated, by the metal plates. The charging voltage causes a concentration of electrons on the negative plate and a corresponding lack of electrons upon the positive one. The charge is "held", in part, by the action of the insulating substance, the atoms of which are so "poled", or twisted around, that their positive sides face the negative metal and their negative sides face the positive metal. Current is thus literally stored in the condenser, remaining even after the circuit is opened. But when the charging voltage declines or is reversed, or if the condenser is short-circuited, discharge takes place.

The significant fact with relation to the apparent conduction of alternating current through the insulation of the condenser lies in the discharge that occurs when the charging voltage decreases or reverses. Consider what happens in a wire leading to one of the metal plates. Current may be thought of as flowing through this wire toward the condenser, charging the plate to which the wire is connected. When partial or complete discharge occurs current flows outward from the same plate, with the result that the direction of flow through the wire in question is reversed. Thus, alternating current flows through that wire.

If a lamp is connected in series with that wire, alternating current will flow through its filament (in spite of the fact that the circuit is broken by the insulation of the condenser), the exact amperage depending upon the amount of charge the condenser can hold under the conditions of operation. Therefore if the condenser is large enough a lamp in series with it will light, an A.C. ammeter will register.

Effect of Voltage Change

A.C. will also flow through the wires leading to the condenser if those wires are connected across unsteady voltage in a D.C. circuit. Whenever the D.C. voltage changes, the charge of the condenser will either increase or decrease. Current will thus flow in and out through the wires connecting to the plates; there will be A.C. in them, although only unsteady D.C. flows in the circuit they bridge. In the case of hookups of this kind it is commonly said that the condenser short-circuits the "A.C. component" of the D.C. line—another convenient misstatement. There is actually no A.C. in such lines. But the effect of a rhythmic rise and fall in direct voltage is the same as if a small A.C. voltage were added to a line carrying steady D.C., *alternately* aiding and opposing the direct potential. Electrolytic condensers are used in circuits of this kind. Their charge increases and decreases but never reverses its polarity. Yet, an A.C. ammeter placed in series with such a condenser would, as explained, correctly register alternating current.

Since a condenser connected across an unsteady direct voltage tends to charge and discharge with changes in the voltage, its effect is to compensate for those changes. The condenser "smooths" out the D.C. The same fact, expressed another way, is described by saying that the condenser short-circuits the A.C. component, and therefore *filters* the D.C. Hum heard in sound systems is often caused by

Showing inside of paper condenser

unsteady voltage in direct current lines, and corrected by wiring condensers in parallel with such lines.

Sound System Applications

Condensers are used in sound systems wherever the unsteady direct voltage requires "filtering." This is the case with direct voltage drawn from a rectifier of any kind. It is very often the case with direct voltage drawn from a generator, because of the "ripple" caused by the action of the commutator. Battery D.C. is "pure" and needs no filtering (under normal circumstances). Sometimes, however, storage batteries are charged by means of a rectifier or motor generator which is used during show time. Often, in such cases, the charging D.C. will create hum in the sound that can be corrected by wiring condensers across the charging line.

Condensers are used in amplifiers to "by-pass" alternating current. Often an amplifier will contain several stages of amplification. The tubes of all stages may be supplied with the power they need to do their work by means of a single source of A current and a single source of B current. But when this is done all stages are wired together at the sources of current supply, with consequent possibility of "feed-back." Speech current of the last stage of amplification may be returned through the common source of power supply to an earlier stage. Feed-back of this kind will cause an amplifier to distort—it may distort so badly that it hums, howls or "motorboats". Condensers prevent this. The speech current of each stage (being A.C.) is short-circuited around the sources of power supply by means of condensers. The power supplies themselves (being D.C.), are not influenced by the condensers, except in so far as the latter serve as filters to smooth out the supply current.

Condensers are also used to influence the phase of an alternating circuit. In the condenser and in the wires connecting to it, current "leads" the voltage. A charge (voltage), cannot be built up across a condenser until current has flowed into it; the current must lead—the voltage or potential difference follows.

Condenser Troubles

The commonest trouble experienced with condensers is short-circuit of the insulating layer separating the plates. If the condenser is connected across a D.C. line to act as a filter, a "short" of this nature will also "short" the line, possibly damaging other apparatus. It is therefore unsafe practice to use filter condensers of doubtful quality, or to use any condenser of any quality without careful consideration of the voltage it will have to withstand and ample allowance for any possible rise in voltage. It is also necessary to remember that in an A.C. circuit voltage changes occur every moment, and the rated, or meter, voltage is *not* the maximum but only the average [more accurately, the root-mean-square] voltage. Thus a condenser wired across a 110-volt A.C. line must withstand a momentary peak voltage of about 155 volts during each alternation,—more than that, if the meter voltage fluctuates above 110, as often happens. If the manufacturer rates his condenser for 110 volts A.C., it may be used with safety—unless the line fluctuation is severe; but if only a D.C. rating is given, it is necessary to remember that the peak voltage of an alternating line in ordinary power service is nearly half again as high as the meter voltage.

Short-circuit in a condenser is commonly tested with D.C., since some A.C. will "flow through" the condenser even if it is in perfect condition. A.C. tests, however, are often useful if conducted with the help of an ammeter.

Short-circuit in a condenser is not always easy to find. Because of the nature of the insulation in common use (tar or wax), the condenser may be "self-healing"—that is, the tar or other insulating compound melts with the heat of the short-circuit, and when the line is opened, seeps about the point of rupture and hardens again. If the condenser is then tested with low voltage, the short-circuit may not be revealed; in fact, the condenser may show no fault even at full operating potential. If the tar or wax is the only insulation, the condenser is literally self-healing, and may be kept in use after it has broken down and cured itself. But in most cases the soft material only reinforces the paper, linen or mica used between the plates, and such a condenser cannot safely be used after it has once given way.

Genuinely self-healing condensers are not common in sound equipment; in general no sound condenser that has short-circuited should be trusted. Suspected condensers, moreover, should *always* be tested at full operating voltage; other tests are valueless.

Electrolytic condensers are self-healing, provided the internal short-circuit is not severe or prolonged. The electroplating action which takes place when the condenser is properly connected is capable of mending slight flaws in the insulating layer. But if this layer has been severely damaged, it can only be repaired by a lengthy process, starting with a very low voltage and gradually increasing it over a period of days. External short-circuiting does not hurt a condenser: the device merely discharges. The heavy sparking sometimes observed when a condenser's terminals are short-circuited is not harmful.

Warning of internal short-circuit is sometimes given in advance when the insulation consists of or is reinforced by tar or wax. This type of insulation may melt in the course of use and leak or force its way out of the condenser case. When this happens the effective insulation between the plates is reduced, with correspondingly increased danger of internal breakdown. A condenser showing this symptom should be replaced before it stops a show or, perhaps, burns out an amplifier.

Open circuit within a condenser cannot be tested with ordinary D.C. methods, since the condenser will not conduct direct current in any case. A.C. may be used for this purpose; or D.C. of suitable voltage may be used to attempt to charge the condenser and then draw a spark from it on discharge.

Large banks of condensers, or electrolytic condensers such as are often used in sound systems, *are dangerous. They hold their charge after the line has been disconnected.* They remain alive after the power switch has been opened. It is unsafe to touch them or any circuit wired to them until after they have been discharged by short-circuiting their terminals.

A complete press book of advertising and publicity material on its High Fidelity sound equipment has been issued by the Photophone Division of RCA Victor Co. for distribution to all exhibitors who have contracted for new installations. This selling aid is a pip and should be used to the limit.

British Initiative

Reporting for the year 1932-33, the Guild of British Kinema Projectionists and Technicians lists the following lectures delivered to its members by qualified technicians: Projector Design, Carbons: Their Manufacture and Use; Television, Mercury Arc and Metal Rectifiers; Sound Systems; Lead and Alkaline Batteries, Optics (3 sessions), and other topics. American projectionists naturally do not need to study such subjects, knowing all there is to know about projection. Technical sessions for American projectionists are practically unknown.

PROGRAM EMBELLISHMENT WITH ULTRAVIOLET EFFECTS

*Alexander Strobl** and *Robert L. Zahour***

***Ultraviolet radiation long has been used as an aid in theatre effect work, although only on a limited scale by means of the carbon arc and almost exclusively in connection with stage presentation work. The accompanying paper, a contribution to the Illuminating Engineering Society, describes a new "black bulb" mercury vapor lamp development which, combining efficiency with simplicity of operation, promises to open up many new applications of ultraviolet radiation effect work in the theatre—not only for stage work, but also in connection with motion picture presentations.*—Editor.**

MORE than three hundred years ago, the Italian scientist Balmain discovered the photochemical property of certain substances to absorb energy from visible light sources, and produce in themselves a luminous glow when observed in the dark. Further study of light sources, capable of energizing these substances, revealed that the longer wave-lengths of the ultraviolet invisible radiations (3,200 A to 4,200 A) are transformed by certain substances into longer waves of a length found in the visible spectrum.

This phenomenal transformation varies in different materials, making available a variety of luminous colors. Pigments extracted from these substances are commonly called "ultraviolet paints", and because of their ability to glow they are said to be "luminescent" when exposed to the ultraviolet radiations.

Two kinds of paints have been discovered for producing practical luminous effects—namely, fluorescent and phosphorescent. Fluorescent pigments are those which become luminous when subjected to ultraviolet radiations. These paints are available in nearly all colors of the rainbow. Phosphorescent paints will emit a self-luminous glow for some period after the ultraviolet has been withdrawn. This latter kind of paint is available in several colors. The phenomenal glowing characteristics of each of these two types of paints permit one to obtain two distinctly different luminous effects when used jointly in a single composite design.

Ultraviolet Equipments

Since most of the early uses of ultraviolet paints were confined to stage effects, the arc spotlight, equipped with suitable glass filters to screen out practically all of the visible light, was used satisfactorily to project invisible ultraviolet radiations on to the specially treated scenes and costumes. Because of the abundance of ultraviolet generated, the arc projector still is employed for this purpose and particularly where coverage of large production scenes at long beam throws is necessary.

An outgrowth of the stage effects brought about uses for ultraviolet paints in advertising posters, small dual-scene paintings, and in miniature design novelties. For these applications, light-tight projectors equipped with dense blue heat-resisting glass filters and ordinary high-wattage Mazda lamps, were found more convenient than arc units. However, due to the proportionately small amount of ultraviolet liberated by Mazda lamps compared with visible light, only medium-density filters can be used for screening out the visible radiations. For some applications, the small percentage of visible light which escapes from these modified equipments is objectionable, while in other cases, it is an asset.

Continued growth in the application of ultraviolet effects has led to the development of dense blue grass mercury vapor tubes, and finally, the "black bulb" mercury vapor lamps. Since the visible light from these sources consists of chiefly blue-green mercury spectrum lines, the thickness of the dense blue filter glass in the tube of "black bulb" is not as great as in the screens employed for masking carbon arcs or high-wattage Mazda lamps. Consequently, more ultraviolet is transmitted for useful purposes.

The mercury vapor tube and its accessories for operation is essentially the same as the standard Cooper-Hewitt lamp, except that the tube is made of a dense blue ultraviolet filter glass.

"Black Bulb" Mercury Lamps

The "black bulb" ultraviolet lamp is similar to the ultraviolet health lamp in construction details and operating characteristics, but is provided with a special dense purple glass bulb which absorbs practically all of the visible light, yet transmits a high percentage of the ultraviolet. In Figure 1 is shown various methods of wiring the 5-ampere, 15-volt "black bulb" ultraviolet lamps of sources of 110-120 volts A.C. Since the lamps operate at 15 volts, they must be burned in series with a 5-ampere reactor when connected to the 115-120 volt A.C. supply. This combination consumes approximately 100 watts. The reactor can be adjusted to operate two or three lamps if desired. A convenient scheme in trough arrangements is to mount incandescent lamps between the black bulb lamps, thereby permitting each circuit to be operated alternatingly through a flasher.

In making their debut upon the

*Stroblite Company, New York City.
**Westinghouse Lamp Co., Bloomfield, N. J.

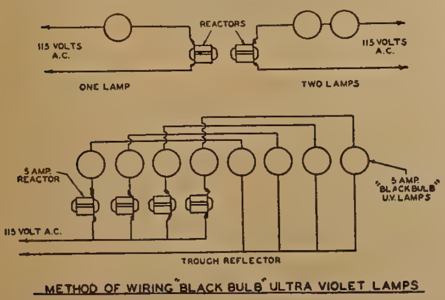


FIGURE 1

Various methods of wiring 5-amp., 15-volt "Black Bulb" ultraviolet lamps on 110-120 volt A.C. circuits

Stage scene from prologue, "King Kong," at Radio City Music Hall (N. Y.), where the shields, spears, and costumes exhibited a variety of luminously-colored designs under the ultra-violet radiations

American stage, Ziegfield's Follies of 1922 brought forth a gasp of admiration from the audience as the stage lights were dimmed to black out, and the pale lace gowns turned luminously brilliant and many-hued. The gowns were treated with vari-colored luminous painted designs which were practically invisible to the audience under the stage illumination, but beautifully luminous in the presence of ultraviolet furnished from concealed foot-lights containing quartz-mercury lamps with special glass filters. Many theatrical productions since have enhanced the beauty of their settings and in some instances, effected dual-scenes on the same curtain drop, through the use of luminous paints.

At the Century of Progress, Chicago, several exhibitors feature posters showing two and three different scenes through the combined use of non-luminous, fluorescent, and phosphorescent paints. In one setting, the wall paper of a room exhibits a simple conventional design of cross-section lines when viewed in ordinary light. Under the ultraviolet radiation, this simple design is transformed into a beautiful, luminously colored sea garden of various fish and flowering plants. The ceiling changes to a sky by night, studded with luminous stars.

Likewise, another exhibitor hangs a large Spanish shawl in a prominent position of a space easily darkened. The edges of this shawl are beautifully marked and under ordinary light the center remains blank. In the presence of the ultraviolet, the edges of the shawl take on a luminous irridescent effect of sailboats, waves, and fish. The company monogram of exhibitor, appears brilliantly in the heretofore blank center.

In a recent exhibit at a large department store in New York City, a unique effect was created in completely changing a dining room into a party setting by switching off the regular light and turning on the ultraviolet. The green walls became covered with luminous flora and fauna, the curtains with foamy waves, the table cloth, doilies, glasses, flowers, etc., glowed in brilliant colors. The furniture appeared to vanish and the hostess's pink lace dress shown in many lustrous hues.

Since the effectiveness of these displays depends largely on the maximum brightness contrast between the untreated areas, which remain dark, and the luminous designs, it is extremly essential that visible light be eliminated. A small quantity of stray light is sufficient to illuminate the dark background, thereby reducing this contrast and consequently weakening the effect.

Varied Applications

With refinements and modifications of present available ultraviolet lighting equipments, and with ultraviolet paints now satisfactorily developed, the art of ultraviolet luminescent effect lighting offers interesting possibilities. Ultraviolet light sources may be concealed in wall urns, indirect floor pedestals, or suspended domes, or in coves, for the purpose of energizing ultraviolet painted scenes or designs in framed pictures, or on the side walls and ceilings.

One of the most attractive and intriguing creations is that of a dual-scene painted on the upper side walls and ceiling of a night club resort or theatre. With the skill of experienced artists, a simple design is painted on these areas in non-luminous or ordinary paints. A second scene, applied with fluorescent paints, is carefully incorporated in the first design, and combined with these, a third view is concealed with phosphorescent paints. Under artificial or natural light, the first design will take prominence. Under the ultraviolet the combination fluorescent and phosphorescent scene will luminously stand out in the dark. On withdrawing the rays, the phosphorescent painted view alone remains visibly luminous.

THE ACCURATE MEASUREMENT OF SCREEN LIGHT VALUES

To find the light factor of your arc, multiply the illuminated area of your screen in square feet by the average intensity in foot-candles to which that screen is raised, and you will arrive at the lumens being projected thereon. For example, you would be using 3,740 lumens to get 10 foot-candles on a screen 22 feet by 17 feet. Supposing now that your arc was using 75 amperes at 55 arc volts, your wattage would be 4,125, and you would therefore be obtaining approximately .9 lumen on the screen for every watt consumed in the arc.

Now, it is this ratio of lumens to watts that is the important thing, because by reference to this figure you can determine the electrical efficiency or light factor of your carbons.

Supposing, in the example we have just taken, that you fit another pair of carbons, and find that you can, for the same arc wattage, obtain 12 foot-candles. Your lumens will now be 4,488, and your light factor will be 1.0 lumen per watt. Conversely, if you found that with the new carbons you could still get 10 foot-candles for an expenditure of only 70 amps., 50 arc volts, your wattage would be 3,500, and your light factor at 3,740, lumens would again be approximately 1.0 lumen per watt.

Having therefore determined the light factor of your carbons, the next

ABC's OF PHOTO-ELECTRICITY

A. J. McMaster
G-M LABORATORIES, INC.

II. *Photo-Conductive Cells*

PREVIOUSLY it was mentioned that the selenium cell is the best known example of a photo-conductive cell. The element selenium, discovered in 1817 by Berzelius, is known as a semi-conductor. Its light-sensitive properties were discovered by accident in 1873. The usual form of cell consists of one or more parallel pairs of conductors which are bridged by a thin film of grey crystalline metallic selenium. Since light can penetrate but a very small depth of the metal, it is desirable to expose as large an area of the sensitive metal as is possible without increasing the resistance to too large a value.

A common construction is a glass plate on which a gold or platinum film is deposited in the form of a grid. Half of the gold film is separated a short distance from the other half by a long zig-zag path in which the selenium is deposited. When an external voltage is applied, a small current rises to considerably greater value. In general the following characteristics are observed:

1. The sensitivity increases with the applied voltage.
2. The sensitivity of very high resistance cells is usually greater than that of low resistance cells—i.e., the current ratio of light to dark values is larger for small values of current, namely, micro-amperes, than it is for higher values, namely, milliamperes.
3. The net increase in current due to light is proportional to the square root of the light intensity.
4. For rapidly fluctuating light, the current output of the cell is nearly proportional to the light intensity and inversely proportional to the frequency.

The static current response to various light intensities is shown in Fig. 9. In Fig. 10 the time rate of response is shown. The lag is apparently due to the fact that as electrons are freed within the metal some of them immediately begin to recombine in their travel to the positive electrode with positive ions. Eventually an equilibrium condition results in which the rate of liberation of electrons from selenium atoms is equal to the rate of recombination. When the incident light is removed, the rate of recombination rapidly reduces the number of free electrons present until the number present becomes so small that the probability of recombination is likewise reduced.

In Fig. 11 the dynamic response of a typical selenium cell is shown. As would be expected, the frequency response is poor, although satisfactory results in the audio range are claimed by the use of properly compensated amplifiers. In Fig. 12, the color response of a typical selenium cell is shown. The cell is sensitive throughout the entire visible spectrum.

In the physical construction described above the light is generally incident at right angles to the flow of current. A second type of cell has some useful properties. In this form the selenium deposited in a thin film on a metallic plate and semi-transparent metallic conductor is laid on top of the selenium. The incident light is parallel to the flow of current and the resistance of the cell is very much lower than that of the other type. Since the voltage dissipation of any selenium cell is limited to a small value, the voltage applied to these low resistance cells must be low.

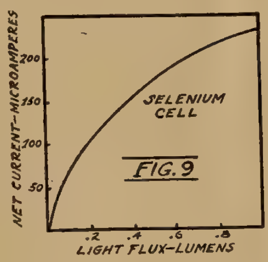
Other forms of photo-conductive cells have been developed with considerable success. T. W. Case discovered the extremely red-sensitive characteristics of oxidized thallium sulphide. The latter serves to bridge the conductors of a grid as in the selenium cell. F. Michelson has alloyed selenium and tellurium to obtain red sensitivity. Other sulfides and oxides have been used but with less success.

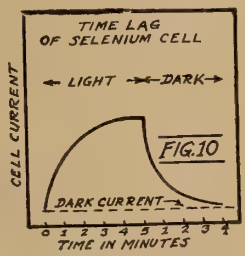
Photo-Voltaic Cells

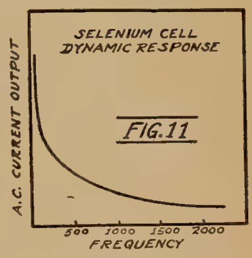
Photo-voltaic cells are among the oldest of light sensitive electrical devices. Becquerel in 1839 observed that light on one of two electrodes in an electrolyte produced an e.m.f. T. W. Case and others have developed this effect to a more or less practical degree.

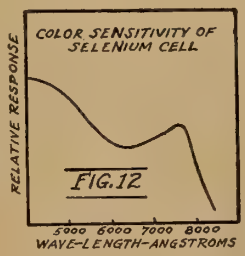
Several years ago the Arcturus Company announced their Photolytic cell, which is of this type. Both of the electrodes are covered with crystalline cuprous oxide and a weak conducting electrolyte surrounds them. When one of the electrodes is illuminated, a voltage appears at the terminals of the cell. The cell is unsuited for furnishing continuous current but is intended for use in sound equipment where the fluctuating light intensity produces a varying voltage. The cell is connected in series with a condenser and the primary of a step-up transformer, the secondary of which is connected to the grid of an amplifier tube.

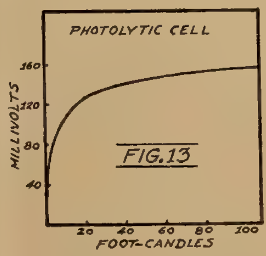
The d.c. potential developed at the terminals of the cell is shown in Fig. 13. It is to be noted that the potential approaches a maximum value of approximately 160 millivolts, beyond which increase of light intensity produces very little rise in voltage. When it is used in sound projection, its principal merit is that it can be connected to the amplifier at some distance by means of a low-impedance line. The frequency response claimed by the manufacturer is shown in Fig. 14. It is customary to use an amplifier which is peaked at the high end. One of the difficulties experienced in the field with this cell has been that the electrolyte

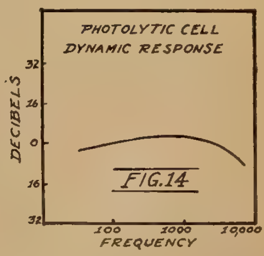






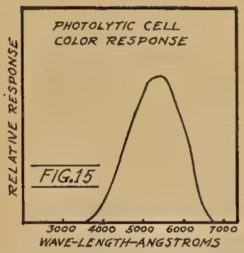


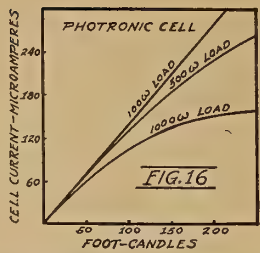


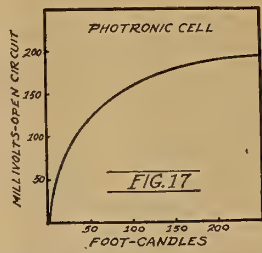


thing to consider is burning rate. If you burned two pairs of carbons of different make but of the same size for an hour, the difference in burning rate might not be very marked, but the slower-burning carbon may well give you an extra two or three-reel run, and leave no appreciable waste end.

Naturally, the most accurate check of screen illumination is to be had through use of a photometer, but very few theatres have such a device available. In the absence of such equipment, however, the foregoing information will serve the purpose admirably. Many projectionists try to estimate costs merely by a comparison of carbon prices, without regard for the factors of burning time and "juice" costs, which figures are absolutely necessary for any fair evaluation of costs.







leaks out of the case in time. Many installations originally equipped with this cell have been changed over to use a photo-emissive cell.

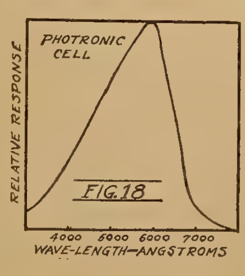
The color sensitivity curve of the Photolytic cell is somewhat similar to that of the human eye. It is shown in Fig. 16.

Both in this country and abroad the electronic type of photo-voltaic cell has been developed and commercialized. In these cells electrons are displaced by the action of light, which results in an e.m.f. at the terminals of the cell. A lic plate upon which is a layer of sen-typical construction consists of a metal-sitive cuprous oxide or other material. On top of this layer is a semi-transparent conducting film. The metal plate and the conducting film are the two electrodes.

The electronic type of photo-voltaic cell is capable of furnishing a continuous current over a long period of time without depreciation. This cell represents a direct converter of light energy to electrical energy. No battery or other source of potential is used in the external circuit of the cell. The current output of a typical cell (Weston), is shown in Fig. 16. It will be noted that the linearity of response and magnitude of the output current is lessened as the load resistance is increased, the reason being that the internal conductance of the cell acts as a by-pass for a part of the generated current, and the greater the external load resistance the larger the proportion of the current which is shunted internally. Furthermore, the resistance of the cell decreases as the light intensity increases (not linearly, however), which accounts for the flattening of the response curve.

In Fig. 17 is shown the open circuit voltage output characteristic. It is an interesting fact that if two similar cells are connected in parallel to a load circuit of resistance R, the current is twice that of one cell, provided that R is small. Also, if two cells are connected in series with a load circuit of resistance R, the current is approximately the same as for one cell connected to a load of ½ R.

The color response of this cell is shown in Fig. 18. The red sensitivity is low, but the characteristic is not greatly different from that of the human eye. The frequency response is very poor due to the high shunt capacity of the two cell electrodes. By making the cells of smaller size this difficulty is reduced to some extent.



[Note: This is the second of a series of articles by Mr. McMaster on types and characteristics of light-sensitive cells. The concluding installment next month will include a comparison of merit of the three types of such cells.—*Editor*.]

Schroeder Opposes Richardson On Brush Fitting Procedure

The following letter anent certain observations by F. H. Richardson on a recent contribution[1] by Mr. Schroeder to these columns is self-explanatory.

MY attention has been directed to certain comments in a recent issue of *Better Theatres* in the course of which Mr. F. H. Richardson, answering an inquiry from Mr. J. L. Schrock of Missouri, criticizes my remarks on fitting brushes. Evidently Mr. Richardson does not like my particular method. He says that the method is O.K. theoretically (which means that it can't be so very wrong), but he implies that it just won't work out practically.

Mr. Richardson's remarks are very inconsistent. He thinks that projectionists will not go to the trouble of raising the brush before pulling the sandpaper back; but in the next breath he suggests that the brush be held with a screwdriver by "an assistant" while the projectionist pulls the paper back and forth. Further along in his comments he says that after sanding the brush and running it in for a half hour, it should be removed two or three times and the shiny spots sanded off each time.

"Six of One—"

Does Mr. Richardson think that a man who will not raise a brush while sanding it will go to the trouble of pulling the brush out two or three times and very carefully sand off the shiny spots until the fit is perfect? Or maybe he thinks that his method is not so much work as raising the brush for the return of the paper. He does admit, however, that pulling the paper in both directions, as *he* suggests, might not be the best way. He says: "However, if you want something a bit better, have an assistant hold a screwdriver against the brush to prevent it from tilting."

Now, it's all right with me, and one may take his choice: either pull the sandpaper in one direction, as I described it, or hold the brush with a screwdriver, as Richardson suggests, and pull the paper both ways. On some machines, however, the construction is such that the brush cannot be kept from tilting by using the screwdriver method, and, in fact, it is very difficult to utilize this method on any machine.

There is one statement in Mr. Richardson's comment from which I most emphatically dissent. He says that certain advice (on projection) is of little value because so few men will heed it. This thought, carried to its logical conclusion, would mean inefficient projectionists and generally poor projection—a clear case of "Oh, what's the use?"

Article Served Useful Purpose

Mr. Richardson must admit that at least one man has benefitted by my article, and that man is his correspondent, Mr. Schrock. The latter says that he has fitted brushes by pulling the paper both ways for a long time—maybe for years—and apparently he has not given the matter much thought. *But*, and this is the important point, he read my article and *started to think about the subject.* "Maybe Schroeder is right and I am wrong," he might have thought. In any event, Mr. Schrock went to the trouble to write a letter to Mr. Richardson and ask for his views on the matter—an act which definitely bespeaks interest on the part of the former.

The chances are that Mr. Schrock now will go to a bit more bother in fitting his brushes. He may even go to the trouble of following Mr. Richardson's advice and pull the brush out two or three times in order to sand the high spots. At least he knows more about the subject than he did before he read my notes, even though they appear to be "too finely spun" to suit Mr. Richardson.

A. C. Schroeder
Los Angeles, Calif.

[1] "The Maintenance of Motor Generators (Part II: Fitting Brushes Accurately)", *Int. Projectionist*, February, 1933, **Vol. 4**, No. 4, p. 10.

Not a few projectionists find the way to a better understanding of developments affecting their daily work barred by an unfamiliarity with mathematics, a subject of increasing importance to the projectionist. Many articles of decided help to the projectionist are hurriedly glossed over because of the difficulty experienced in correctly interpreting mathematical terms and symbols and, in particular, in applying mathematics to one's work.

The accompanying article is the first of a series which is intended to meet this acute need within projectionist ranks. The series begins with consideration of fundamentals (by which is meant simple arithmetic), and progressively works along toward and deals with algebra, geometry, trigonometry and the calculus. The articles are infinitely more interesting than one might suspect from this description of their content, the transition from one stage of the work to another being accomplished in easy step-by-step fashion. The value of this series to the projectionist can be measured beforehand in terms of the degree of determination which he exhibits in applying himself thereto. Unquestionably the series should prove exceedingly helpful; but this publication can do no more than present it in these pages.

Following each installment will be a group of questions bearing on the information given immediately preceding. Projectionists are invited to send in to INTERNATIONAL PROJECTIONIST their answers to these problems. The names of those who submit correct papers will be printed along with the answers in the following issue.—*Editor.*

MATHEMATICS FOR THE PROJECTIONIST

Gordon S. Mitchell

THERE is probably nothing which seems more complicated or is more discouraging than to look ahead in a mathematics course, with its complex formulæ and intricate text explanations. By the same token there is nothing that gives one more real satisfaction than to glance back over the problems and the text of a course well done, realizing that those things which seemed to be most involved have proven to be rather simple after all.

To shorten and simplify many of the principles and operations of the more advanced mathematical subjects, a knowledge of the four arithmetical fundamentals is necessary.

Individuals react in different ways to numbers and numerical calculations, and while there are countless shortcuts and tricks which may be used in arithmetical calculations, many of these require as much or more mental effort as would a straightforward solution of the problem at hand. In adding a column of figures, such as might be necessary in order to determine the total resistance of a set of resistors connected in series, it is well to carry only the totals mentally as the columns are added. For instance, in adding:

$$\begin{array}{r} 749 \\ 987 \\ 765 \\ 579 \\ 682 \\ 224 \\ 374 \\ \hline \end{array}$$

from the bottom to top of the right-hand column of figures, the mental operation would be somewhat as follows: 4, 8, 10, 19, 24, 31, and 40. The 0 should be placed as the right-hand figure of the sum, the 4 carried to the next column, which will add somewhat as follows: 4, 11, 13, 21, 28, 34, 42, and 46. Placing the 6 in the sum and carrying the 4 to the next column, and so on, we obtain a total for the column of 4,360.

As a method for shortening the mental labor involved in adding a column of figures, and after some dexterity has been obtained in handling numbers, groups of numbers in any column which total 10 may be mentally grouped and considered during the adding process as one number. Referring to the example above, we would by this method group the lower three figures in the right-hand column (the 4, 4, and 2), mentally and add them as 10, 19, 24, 31, and 40. In like manner, the second column would be added, 4, 11 (grouping the 8 and 2), 21, 28, 34, 42, and 46. As additional practice in adding increases mental skill, it will become possible to group numbers which add to ten, although they may not appear together in the column, and thus increase the speed of addition. The second column of the foregoing example would then be added 4, 11, 21, 28 (grouping the 6 and the 4), 38, and 46.

Subtraction of numbers probably presents as little difficulty as any mathematical operation, but a single example will be solved in order that a complete set of fundamental processes may be had for any reference or practice which may be desired. Given the number 1,234, which is to be subtracted from 4,321:

$$\begin{array}{r} 4{,}321 \\ 1{,}234 \\ \hline \end{array}$$

it can be easily determined that 4 cannot be taken away from 1, consequently it becomes necessary to "borrow" 10 from the adjacent number, making our first subtraction 4 from 11, leaving 7. Inasmuch as we have borrowed 10 from the 2, we find in the next column a subtraction of 3 from 1, which is again impossible, and necessitates borrowing 10 from the adjacent 3. This subtraction then becomes 3 from 11, leaving 8. In the next column, our 3, having by reason of the borrowing of 10 during the previous subtraction, become reduced to 2, leaves a subtraction of 2 from 2, which is 0. A straightforward subtraction of 1 from 4, leaving 3, completes the operation, giving an answer of 3,087. This may be readily checked by adding the answer, 2,087 to the number being subtracted, 1,234, which gives the sum of 4,321.

An important point, and one which often proves puzzling, is the problem of adding or subtracting unlike units.

Any group of numbers, in order that they may be correctly operated upon mathematically, must either originally be all of the same unit or converted to the same unit before any calculations are made. Thus, it is impossible to add bananas to apples to obtain any sum other than, say 5 bananas and 6 apples. In like manner, it is not possible to add volts to amperes, or frequency to decibels. Units which are multiples of some other unit under consideration (as for instance, volts and milli-volts), may be added after the proper conversion factor has been introduced. For instance, to add 117 milli-volts to 23 volts, it would be necessary to convert both numbers to milli-volts, and the sum would become 117 milli-volts added to 23,000 milli-volts, or 23,117 milli-volts, total.

Multiplication has been described as merely a short-cut method of addition, —as, similarly, is division a short-cut method of subtraction. It can easily be understood that if we were to add seven fives together, we would arrive at the sum of 35; but to considerably shorten this process we multiply the five by seven to arrive at the product 35.

Let us consider the number 9,745, which is to be multiplied by 486. This, for purposes of calculation, may be considered as 9,745 multiplied by 6, plus 80, plus 400. If we multiply the 9,745 by 6, we obtain the product 58,470 (6 times 5 equals 30, putting down the 0 and carrying the 3; 6 times 4 is 24 plus the 3 carried over, making 27—put down the 7 and carry the 2; 6 times 7 is 42, plus the 2 carried over is 44—put down the 4 and carry the 4; and 6 times 9 is 54, plus the 4 carried over makes 58).

Similarly, multiplying the 9,745 by 80, we obtain the product 779,600, and when we multiply the same number by 400 we obtain the product 3,898,000. Adding these three products together, we see that the total is 4,736,070.

$$\begin{array}{r} 9,745 \\ 486 \\ \hline 58,470 \\ 779,600 \\ 3,898,000 \\ \hline 4,736,070 \end{array}$$

Many times, in electrical formulæ, a number or a letter will appear followed by an exponent, such as 5^2 or F^3. These are read as "5 squared" or "F cubed," and mean that the number so modified is to be, in the case of the exponent 2, *squared* (multiplied by itself) or in the case of exponent 3, *cubed* (multiplied by itself twice). Higher exponents, as 5^4 or F^7 are read as "five to the fourth power," or "F to the seventh power," respectively, and merely mean that the number is to be multiplied by itself a number of times one less than the numerical value of the exponent. Numbers so modified may be substituted for in any formulæ in the following manner,—5^2 may be replaced by 5 x 5, or F^7 may be replaced by F x F x F x F x F x F x F. The actual method of handling such numbers, which may be considerably simplified beyond an actual multiplication of the number by itself for any given exponent, will be taken up subsequently.

The fourth arithmetical operation with which we are concerned is division, which is probably the most difficult of the group. Division should be thought of always as the reverse of multiplication; for instance, 5 x 6 being 30,—30 divided by 6 will equal 5, as will similarly 30 divided by 5 equal 6.

When the number to be divided (the *divisor*), into any larger number (the *dividend*) is smaller than 10, it is customary to use the process known as *short division.* Short division is entirely a mental process, and should present no difficulty, after some practice, to one who has mastered the multiplication table. If, for example, it is desired to divide 544 by 8, by short division 8 will go into 54, 6 times with a remainder of 6 left over (6 times 8 being 48, and 54 less 48 being 6). Carrying the remainder of 6 to our next figure, 8 will go into 64 exactly 8 times, giving a quotient (the result of the division operation being known as the *quotient*) of 68.

The process of *long division* is essentially similar to that of short division, except that certain figures are set down on the paper to simplify the mental effort connected with the operation. Considering the number 2,431 divided by 17:

$$\begin{array}{r l} 143 & \quad (a) \\ \hline 17)2431 & \\ 17 & \\ \hline 73 & \\ 68 & \\ \hline 51 & \\ 51 & \\ \hline \end{array}$$

As the number 17 obviously is too large to be divided into 2, we try the next figure, successfully making our division 24 by 17. As 17 will go into 24 once only, we place our 1 in the space provided for the quotient (line a, in the example above), multiply 17 by 1, placing this result below the 24. Subtracting, we obtain a remainder of 7. Bringing down the 3 from the dividend above, we again determine by trial and error that 17 will go into 73 approximately 4 times. Placing the 4 in the quotient line above, we multiply 17 by 4, obtaining 68, which is subtracted from 73, leaving a remainder of 5. Bringing down from the quotient above the figure 1, we determine that 17 will go into 51 approximately 3 times. Placing the 3 in the quotient, and multiplying, the product equals 51 and there is no remainder.

However, should the dividend have been, instead of 2431, 2435, it can be determined that after the final operation above there would have been a remainder of 4. This may be handled in a variety of ways, but for present purposes it will be best to carry any remainder as a proper fraction, in this case 4/17, making the quotient 143 and 4/17.

For technical calculations, the use of decimals has become universally standard, and all technical formulæ, units, and tables are based upon the decimal system, which is merely a method for expressing and handling numbers less than 1, in terms of tenths. Calculations and use of the system should present no difficulty, in that the entire monetary system of the United States is based upon the decimal. In adding or subtracting decimals, it should be borne in mind that the decimal point should always be kept in the same vertical line, as follows:

$$\begin{array}{r} 8.754 \\ 9{,}023.02 \\ .1111 \\ 97.5 \\ \hline 9{,}129.3851 \end{array}$$

In the multiplication or division of decimals, this is not the important factor. In multiplication, the actual multiplication is done exactly as if there were no decimals, and the total number of figures ("places") to the right of the decimal in both multiplier and multiplicand is determined, and the decimal placed the same number of "places" to the left in the product. An example:

$$\begin{array}{r} 45.73 \\ 22.2 \\ \hline 9146 \\ 9146 \\ 9146 \\ \hline 1015206 \end{array}$$

which after correctly placing the decimal point, becomes 1,015.206.

In dividing decimals, the common practice is to, in effect, multiply both divisor and dividend by a factor of 10 which will make the divisor a whole number, and then proceed in the usual way. For example, if it is desired to

divide 7,345.729 by 63.23, both of these numbers would be multiplied by 100, making the actual numbers 734,572.9 divided by 6,323. This operation is done in accordance with the algebraic rule (which will be taken up in detail in the third lesson), which states that both divisor and dividend (or multiplier and multiplicand) may be multiplied by the same number without altering the fundamental relation between them.

In calculation in connection with sound systems, decimals to many places will oftentimes be encountered, especially in considerations of resistance, capacity and inductance. The commonest decimal units follow:

.1 equals 1/10 (one-tenth).
.01 equals 1/100 (one one-hundredth).
.001 equals 1/1000 (one one-thousandth).
.0001 equals 1/10,000 (one ten-thousandth).
.00001 equals 1/100,000 (one one-hundred-thousandth).
.000001 equals 1/1,000,000 (one-millionth).
.0000001 equals 1/10,000,000 (one ten-millionth).

The usual method of speaking of decimal figures is to regard .1 as "point one," or "one tenth"; while .007 would be regarded as "point 0-0 seven," and .0000023 as "point 5-0's two three."

In order to apply the foregoing considerations let us discuss for a moment a typical problem, such as might be encountered during an ordinary working day of a sound engineer in the recording room or the projection room:

A milliameter is on hand, having a resistance of 40 ohms and registering a maximum of .25 amperes. It is desired to use the milliameter as a voltmeter, to measure a potential slightly under 300 volts, which can of course be done, provided a suitable resistance is placed in series with the meter. By Ohm's Law (and a set of entirely arithmetical calculations), the necessary resistance may be determined. (Ohm's Law:—E equals I x R, or R equals $\frac{E}{I}$.)

First, let us calculate the necessary total resistance which will be needed to limit the current to .25 amperes at a potential of 300 volts: R equals $\frac{300}{.25}$, or R equals 1,200 ohms. As we know (given above) that the resistance of the meter itself is 40 ohms, it will be necessary to add a total external resistance of 1,160 ohms to the meter in order to safely measure a potential of 300 volts.

In the next paper, the subject of logarithms, and the many ways in which they may be used to shorten what would otherwise be tedious mathematical operations, and the application of arithmetic and logarithms to the operation of the slide rule will be discussed, to be followed in succeeding issues by papers dealing with algebra, geometry, trigonometry and the simple calculus.

[NOTE: Meanwhile there is appended hereto a series of problems the solving of which will be excellent practice and will serve to show how well you have absorbed the foregoing information. Numbers will be applied to all questions, the answers to which will be given in the following issue. As was stated in a foreword to this installment, readers are invited to submit their answers in advance of publication of the following issue, in which will also appear a list of the names of those who have correctly answered the questions. These question and answers will be a feature of this series.—*Editor*.]

Problems:

1. In a group of resistors, there are units having the following resistances: 184.75 ohms, 25,000 ohms, 22.39 ohms, 6.5 ohms, 4.450 ohms, 50 ohms, 100.33 ohms, and 75.75 ohms.

What is the total resistance of the group?

2. The formula for power in any circuit is Power in watts equals E (voltage in volts) x I (current in amperes).

What is the power in a circuit carrying 25.4 amperes at 32.33 volts?

3. It is desired to divide a total resistance of 20,000 ohms into 3 smaller resistances, one of which will be .23 of the total, one .57, and the third .20.

What are the three resistances?

4. Ohm's Law states that the current equals the quotient of the voltage divided by the resistance (with current in amperes, voltage in volts, and resistance in ohms).

With a voltage of 110 volts, and a resistance of 5.5 ohms, what current will flow in the circuit?

"SEEING" SOUND BY MEANS OF NOVEL PROJECTION PROCESS

R. F. Mallina

MEMBER, TECHNICAL STAFF, BELL TELEPHONE LABORATORIES

IN ACQUAINTING the visitors to the Century of Progress Exposition with some of the essentials of modern electrical communication, it seemed very desirable to allow them both to hear and see the forms of the signal waves sent over certain types of telephone circuits, and to compare them with actual speech waves.

By using an available type of loud speaker, the signals could easily be heard by a large audience. No apparatus was available, however, which would make the signals easily visible to the larger groups that gather at the exhibit, although an ordinary oscilloscope would serve to make the signals visible to one or two people at a time. But by adapting telephone apparatus to serve as the actuating element of the oscilloscope, there was developed in Bell Laboratories a new oscilloscope, shown in Fig. 1, which throws the image of the signals on a large screen where they may be seen by a large number of people.

The function of an oscilloscope is to represent an electric current, that varies in strength with time, by a point of light that varies in vertical distance above some base line with distance along that base. The transformation is accomplished by two separately acting mechanisms, and by employing a powerful source of light, reflected by a mirror, as the visible image. The current to be depicted is passed through a telephone receiver such as is used in the ordinary handset. A small spherical mirror is attached to the diaphragm of the receiver so that variations in the current tilt the mirror up and down. The mirror reflects a ray of light from a small electric lamp, like those used in automobile headlights, onto a small motion picture screen, where it may be seen by the spectators. The up and down motion of the reflected ray of light accurately corresponds to the variations of the current, and thus to the variation in pressure of the original sound.

The Projection Process

The motion of the light across the screen is provided by a rotating mirror as shown in Fig. 2. Here the mirror

Figure 1

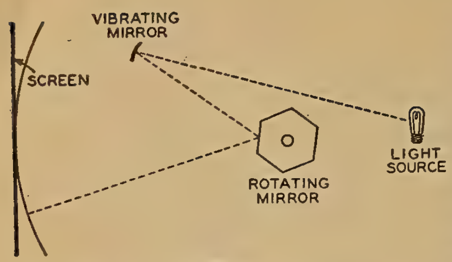


FIGURE 2

Simplified schematic of mirror arrangement of the large oscilloscope

is shown as consisting of six plane mirrors forming a hexagon; in the actual oscilloscope twenty mirrors are employed, arranged in a regular polygon and rotated by a small motor. Light from the lamp falls on the mirror on the receiver and then is reflected to the rotating mirror. The motion of this rotating mirror throws the beam across the screen at the same time that it may be rising or falling due to the vibration of the mirror on the receiver. The faster the mirror rotates the more will the waves be spread out on the screen, and a speed is selected that will give the best effect for the ordinary sounds of speech and music.

The twenty faces of the rotating mirror successively pick up the beam reflected from the small mirror on the receiver and flash it across the screen. The mirror is rotated at thirty-three revolutions per minute, so that the time required for one of the twenty sides to flash its image across the three-foot screen is a little less than one-tenth of a second. What one really sees, therefore, is a succession of pictures, each representing the sound wave for a period of about a tenth of a second. The persistence of vision is long enough so that the curve is seen over the entire length of the screen, but not long enough to cause interference between successive images.

These oscilloscopes are used at the Exposition in association with two of the Bell System exhibits. One of them is employed to show some of the essential characteristics of speech and music. Typical speech sounds are listened to, and at the same time their wave-form is watched on the oscilloscope. High-pitched sounds show waves close together, and loud sounds result in waves of greater height. Filters of various types are also inserted and their effect in cutting out certain of the frequencies is both seen and heard.

Erpi's New 1-Year Agreement On Service and Replacements

ELECTRICAL Research Products has for the past several months been "making available" to exhibitor licensees of W.E. sound reproducing apparatus a new agreement covering both servicing and replacement parts under the terms of which the company assumes full responsibility for the continued operation and maintenance of all W.E. sound equipments, numbering some 5,000-odd throughout the United States. More than 600 theatres have already signed this new agreement, according to Erpi.

The agreement is characterized by Erpi as a furtherance of "its policy of contributing in every way to the development and maintenance of the highest quality sound operation," but other well-informed observers within the sound field view this latest move as a means of accomplishing the following Erpi objectives:

1. Removing the "sting" of compulsory servicing by stressing the "voluntary" character of the new agreement.
2. Avoiding further complaint by exhibitor licensees on the score of that section of the old contract requiring the purchase of all replacement parts from Erpi, a provision which was held illegal by Federal Judge Nield in the recent Wilmington decision.
3. Effectively blocking the path of the so-called independent manufacturers and distributors of replacement parts (in particular, tubes and photoelectric cells), the activities of whom within the past several years are known to have put a serious dent in Erpi's replacement business.

Erpi's Position

Erpi describes this new agreement in the following terms: "The agreement relieves exhibitors of the detail of ordering individual replacement parts. Erpi, in return for a weekly payment, assumes the obligation of making repairs and furnishing necessary replacement parts for the normal continuous maintenance and operation of the equipment. Installation of the parts is made in the theatre under Erpi's supervision . . . We have received gratifying assurances of the results to date from exhibitors who have been operating under this agreement, and we feel that it will be a constructive move benefiting the entire industry."

Following the recent Wilmington decision Erpi sent to all its exhibitor licensees a letter which stated in part:

"The provision in the theatre equipment contract, enforcement of which is enjoined by the Court, is that which obligates the exhibitor to obtain from Electrical Research Products Inc. all additional and renewal parts and assembly parts required for the operation of the equipment . . . The Court denied the request of the Plaintiffs for temporary injunctions against other parts of the exhibitors' and producers' contracts, including the service charges which were attacked in the suit . . .

"Many exhibitors have entered into a separate agreement with us covering our furnishing spare and replacement parts as required for the normal maintenance and operation of our equipment and the payment of a weekly sum in consideration of the furnishing of such parts. These maintenance agreements are in no way involved in the above decree.

"There has been apparently considerable misunderstanding about the significance of this recent Court decision and we hope through the foregoing statement to make clear to our customers this company's position."

Independents Alarmed

Independent manufacturers of sound equipment accessories, supply dealers and those projectionists leaders who hoped ultimately to gain control of servicing are considerably disturbed over the rapid spread of the Erpi blanket agreement idea. Should Erpi sign all W.E. licensees to this new agreement, nearly one-half the sound picture field would be closed to the products of independent manufacturers, not to mention the activity of supply dealers in trade of this kind.

RCA Victor Co., Inc., recently abolished compulsory servicing and the system of leasing its Photophone apparatus. Exhibitors who have paid the fixed price for a given Photophone equipment assume full title thereto, and servicing by RCA is entirely optional. Projectionists have profited through this RCA policy by arranging to service those Photophone sets which do not use RCA service.

Notice!

INTERNATIONAL PROJECTIONIST subscribers can do much to insure prompt receipt of their copies, and will save the publisher much effort and expense, by submitting changes of address as early as possible. The return cards used by the Post Office are expensive to the publisher, and very often offer no clue to a subscriber's new address.

Please.

ANOTHER 16 MM. CAMPAIGN

With a battery of 75 portable 16 mm. sound-on-film projectors, just purchased from Bell & Howell Company, the Plymouth Motor Corp. is embarking on its most ambitious program of selling via movies. Seven 1000-foot sound pictures, built for the most part around human interest and dramatic stories illustrating the advantages of the Plymouth car, will be used with the projectors.

The pictures are designed not only for special dealer meetings, sales conventions, and for use by retail sales managers, but also for special showings to the general public.

FACTORS AFFECTING THE USEFUL LIFE OF CREENS

ONE cubic inch of air contains 150,000 particles of dust. In cities a large part of the dust is coal and soot. The burning of one ton of coal releases 20 pounds of soot and dust containing sulphuric and hydrochloric acid. Dust and soot destroys everything it comes in contact with.

A sound screen is porous. The air goes through the screen, the dust and dirt stays on the surface. As time goes on the density of the dust accumulation is increased to a point where it becomes conspicuous as black streaks, smudges and discolorations.

In the winter, the stage or platform is generally colder than the auditorium. The screen becomes chilled, resulting in a slight condensation of moisture on the surface. Although the condensation may not be perceptible to the eye or the touch, it is sufficient to cause the dust in the air to adhere to the screen.

Dust forms a film on the surface of the screen, and each day this film gets thicker until it is a dark gray in color. As the dust gets thicker the projection light gets dimmer, the picture becomes dull and hazy, and it becomes increasingly difficult to get the picture in sharp focus.

The gradual loss of light brilliancy due to dust makes it necessary to gradually increase the amperage at the arc. This means shorter life to the carbons, and a greater current consumption. Dust also filters into the tiny sound holes, gradually closing up or at least reducing their size. This means a loss of sound volume in direct proportion to the extent to which the holes are clogged up. As the dust gradually clogs up the holes, it becomes necessary to increase the volume at the speakers. This causes added strain on the tubes and batteries, shortening their life. When more current is applied to the tubes in order to force the sound through the clogged up sound holes, overloading of the tubes is bound to occur, resulting in unnatural, distorted sound quality.

Sound screens can be cleaned, but it is a process that requires skilled help to make it successful. The Walker Screen Corp. has said all there is to say in the following statement:

"There is no satisfactory way of cleaning a screen despite many claims of manufacturers that screens can be washed. From the purely technical angle it is impossible to wash a screen. The fabric itself is washable and can be cleaned very easily, but it is almost humanly impossible to remove all of the dirt from so large an area as that of a motion picture screen, evenly and uniformly, without leaving streaks.

Remove Dust Uniformly

"The question of cleaning resolves itself down to the ability of an individual to remove the dirt *uniformly* from a large area. The particular cleanser used has very little bearing upon the subject as a screen can be washed with equal results with any reliable soap dissolved in warm water, the solution applied with a sponge and the screen rinsed off with clean water. Good results apply only to small areas, however.

"Every major circuit has devoted a great deal of time to cleaning of screens. Up to date the most satisfactory means found is to brush off the screen with a fine goat's hair brush at least once a week from the time it is installed. In this way the surface can be kept fairly free of dust. In case a vacuum cleaner is available, excellent results can be obtained by reversing the action of the cleaner and blowing the dust and dirt off the screen from an angle."

Rate of Discoloration

While opinions vary as to the life of a sound screen, it has been definitely established that discoloration caused by age, dust and dirt reduces the reflection value an average of 10% every three months. This makes a total of 40% in a year. In cities and manufacturing centers the loss in reflection value is even greater. The importance of this loss can well be understood if it is considered that the average perforated screen has when new a reflection value averaging 75%. Under extremely favorable conditions, this represents 10 F.C. (foot-candles) in each sq. ft. of the screen.

A 40% loss in reflection value means reducing the screen illumination to 6 F.C. per sq. ft., or practically cutting the brilliancy of the picture in half.

The projectionist and the house staff become so accustomed to the appearance of the screen that they do not realize the gradual loss of light that is taking place day after day. Loss of light on the screen begins as soon as it has been installed, and the loss continues to accrue as long as the screen is in use.

Maximum Useful Life

The conditions obtaining at the theatre with respect to the care given the screen, the dust in the house, chemical conditions of the atmosphere, etc., all control the useful life of the screen. It is safe to say, therefore, that the maximum useful life is from 18 months to two years, though it can be readily proven that the majority of theatres would save considerable money in current and carbon consumption if the screen were replaced at least once a year.

Hollywood and New York Papers Please Copy

The Spio Commission, in which all branches of the German film industry and the German government are represented, has announced its firm decision to bring about an extensive cut of all star salaries and to bring down the wages for even the bearers of the best-known names to a basis which is tolerable to the producer, the renter and the exhibitor.

If the stars should turn a deaf ear to the appeal for a voluntary reduction, there is no doubt that their names and salaries they demand, which have been running up to 70-80,000 marks for a film of about four weeks' production, will be made public in the press. These stars, no matter how strong their drawing power, will find themselves excluded from forthcoming German productions.

THE NEW ALTERNATING CURRENT PROJECTION ARC

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Supplementing the article on the new A.C. carbon arc which appeared in our April issue is the accompanying very much more detailed exposition of this subject which was presented to the Spring, 1932, meeting of the S.M.P.E. Of particular interest are the various tables which tend to sustain the claims, relative to economy and efficiency, which have been advanced in favor of this new arc, a development of the National Carbon Co.—**Editor.**

IN projecting motion pictures, several grades or types of carbon and several makes or designs of lamp are used. But all the grades of carbons produce arcs of only three fundamental types; and all the lamps can be placed in one of three classes if the very few installations still using lamps of the condenser type, burning either direct-current, neutral-cored carbons or the white-flame, alternating-current special carbons, be omitted. The three carbon arc types are (1) the high-intensity, rare-earth, cored-carbon, direct-current arc; (2) the plain neutral-cored, direct-current arc, and (3) the so-called special white-flame, alternating-current projector arc.

The three lamp classes and the carbons burned in them are shown in Table I.

Both Classes I and II use the direct-current, high-intensity arc, which produces the brilliant light of blue-white sunlight quality universally considered desirable in the theater. In the range of current used in these two classes, there is no gap of any magnitude, so that the theaters using these high-intensity arcs can easily arrive at the level of screen illumination best suited to their particular conditions.

There is a large drop in current value, however, between the high-intensity arcs of Class II and the low-intensity arcs of Class III; and the color of the light from the low-intensity installations, while appearing a brilliant white viewed by itself, is yellowish-white when compared with the high-intensity sources of Classes I and II.

A large number of the theaters using the low-intensity light sources desire the same blue-white light of the high-intensity sources, but to obtain this desirable light color would require a change to more expensive lamp equipment and higher power cost.

Bridging the Gap

To bridge the gap between the high-intensity and low-intensity arcs, and at the same time to give the small theater the advantage of the blue-white light enjoyed by the large theaters, has been the object of researches in the laboratories of the National Carbon Co. for several years. The results of this long research show that it is possible to fill the gap between the high-intensity and low-intensity sources with an arc giving a light color very similar to that of the high-intensity arcs, which will also provide a number of other advantages to theater owners of Class III, who outnumber the high-intensity classes by two to one.

The desired result has been accomplished by means of an alternating-current arc burned on the secondary of a specially designed transformer, without the ballast resistance, always necessary with direct current, and also without the motor-generator set or rectifier now required in the vast majority of theaters of all classes. This alternating-current arc is a modified white-flame arc with specially designed carbons containing compounds of the cerium rare earth group of elements. The accompanying Figs. 1 to 4 show the differences in the light sources of various carbon arcs and why this new alternating-current arc should be of great value in projection.

Fig. 1 is a front and side view of a high-intensity arc, showing very clearly the very brilliant, concentrated light source at the positive crater and

TABLE I

Classes of Projector Lamps and Carbons

Class	Kind of Carbon	Type of Lamp	Current Used (Amps.)	Per Cent of Carbons Used
I	11-mm. high-intensity positive carbon 13.6-mm. " " " " 16-mm. " " " " $^{11}/_{32}$" to $^{1}/_{2}$" Orotip negative carbon	Condenser lenses, rotating positive carbon	85–150 d-c.	15
II	9-mm. high-intensity positive carbon $^{5}/_{16}$" Orotip negative carbon	Reflecting mirror, rotating positive carbon	65–85 d-c.	18
III	7–10-mm. reflecting arc negative carbon 10–14-mm. " " positive "	Reflecting mirror, non-rotating positive carbon	16–42	60
Miscellaneous:	White-Flame A-c. Special Low-Intensity D-c. Arcs with Condenser Lenses			7

Showing Differences in Light Sources of Various Carbon Arcs Now in Common Use

Fig. 1. Direct-current, high-intensity arc

Fig. 3. Alternating-current, white-flame arc

Fig. 2. Direct-current, low intensity arc

Fig. 4. Alternating-current arc

why this arc is easily adaptable to an optical system employing either a mirror or condenser lens. This type is used in light source Classes I and II.

Fig. 2 is a direct-current, neutral-cored carbon arc (used in Class III light sources), in which the light source is the brilliant crater on the positive carbon. This figure shows the much less brilliant negative tip and the very faint arc stream between the carbons. This shows, as in the high-intensity arc in Fig. 1, that by far the largest part of the light comes from the positive crater.

Fig. 3 is an alternating-current, white-flame arc, burning carbons containing cerium group compounds. The light source is the brilliant flame between the electrodes; but the electrodes themselves are relatively dim, and emit only a very small fraction of the light. Such an arc, while producing a great deal more total light than a neutral-cored carbon arc using the same power on direct current, is obviously unsuitable for projection, as it is too large to be readily focused through an optical system and its intrinsic brilliancy is too low.

The light emitted by the white-flame arc at currents up to 30 or 35 amperes increases directly as the voltage, but as the square of the current. The rate of increase in light, with increasing current, decreases above 30 or 35 amperes until at very large currents the rate of light increase becomes equal to the rate of current increase. Increasing the current, which, if no other adjustments are made, will also cause a small increase in arc voltage, will therefore very materially increase the light produced. If, instead of permitting the arc voltage to increase with increasing current, the arc voltage and also the arc length be decreased, the arc becomes steadier and the sources of light are concentrated into smaller volumes near the electrode tips, as shown in Fig. 4. This arc is quite different in character from any other arc of which we know today. Either of these small, brilliant light sources can be focused by means of a mirror, and therefore can be used for projection.

Despite the fact that practically all the useful projection light comes from only one of these sources, early experiments showed that with this alternating-current arc at least 15 per cent more light could be projected to a screen with a given optical system and aperture plate than with a low-intensity, direct-current arc using the same line power. The color of the screen light from the alternating-current arc was blue-white, resembling that produced by the direct-current high-intensity arc.

Additional Advantages

In addition to these advantages is the fact that ballast resistances, expensive switchboards, and motor-generators are unnecessary. The motor-generator and ballast resistance are replaced by a relatively low-priced transformer, and the switchboard can be very simple and cheap.

A number of years ago Mott found that if two alternating-current arcs, one with resistance and the other with reactance ballast, were operated with the same line power, the arc with reactance ballast produced 33 per cent more light. There is no reason why the new alternating-current arc can not be controlled with a ballast resistance; but Table II shows that since the transformer will cost little or no more than a good resistance unit, there should be no incentive to use the resistance.

The carbons for this alternating-current arc service have been made in 6-mm., 7-mm., and 8-mm. sizes for use at 40-45, 60-65, and 75-80 amperes, respectively. A large number of laboratory tests have been made on these sizes. Since the current densities are about 800 to 1,000 amperes per square inch of cross-section, it is necessary to use metal-coated carbons.

The carbon consumption is approximately 4 to 4.5 inches per hour for the 6-mm. carbons at 45 amperes, and 4.5 to 5.5 inches per hour for the 7-

TABLE II

Power Required for Equal Screen Light Using Resistance and Transformer Control

Control	Line Voltage	Arc Voltage	Arc Current	Power Consumption in Watts
Resistance	115	30	80	9200
Transformer	115	30	80	2500*

* Assuming transformer efficiency of 95 per cent.

mm. carbons at 65 amperes and the 8-mm. carbons at 80 amperes.

Wholly Satisfactory Results

The uniformity of screen illumination is as good as that obtained with direct-current arcs, as shown by Table III. The same optical system, consisting of a reflector, aperture plate, and objective lens, was used in these tests. There was no rotating shutter in the system. It should be noted that these data were obtained on a laboratory set-up, and while they are perfectly comparable among themselves, they are not indicative of what might be obtained with any other set-up of optical system and screen.

Table III shows that there is no question that the uniformity of screen illumination with the new alternating-current arc is equal to that of the low-intensity, direct-current arc, with the very distinct advantage that the blue-white color of the light resembles very closely that obtained from the direct-current, high-intensity arc. There are not yet available detailed comparisons of the arcs of higher amperages, but a sufficient number of measurements have been made to be certain that Table IV provides a general idea of what may be expected from these alternating-current arcs in terms of well-known direct-current projection systems.

In arriving at the values for line watts an efficiency of 80 per cent has been assumed for the motor-generator sets in the case of the direct-current arcs and 95 per cent for the transformers for the alternating-current arcs. One practical test has been in progress since September, 1932, in a theater with a 12 x 16½-foot screen and a throw of about 100 feet. There have been no complaints concerning the quality of the screen light or the quantity, and no unusual operating troubles have been encountered.

In order to furnish a general idea of the probable fields of use for this arc there is given in Table V a general summary of carbons, currents, voltages, wattages, and screen light in arbitrary units on a screen of a given size. The optical systems were the conventional ones employed with the different kinds of carbons and lamps in actual use in the theaters.

MEMBER: Since the arc is supplied directly from the a-c. supply lines through a transformer, every voltage variation of the outside lines will be transmitted to the arc. In view of the fact that all power companies allow themselves a variation of at least 5 per cent above and below the normal voltage (a total of 10 per cent between minimum and maximum), what would be the effect of such variation on screen illumination and flickering?

MR. DOWNES: We have not found a 5 per cent variation in voltage in our laboratories and factories except at two very definite times each day: in the morning when the factory starts and in the evening when the greater part of the power load is taken off the line. Such a condition may be found in an industrial district where the loads are heavy, but we have thought the voltage changes in our laboratories to be largely confined to our own lines on the low-voltage side of the power transformers serving both factory and laboratory. If difficulty is encountered with variable voltage, the trouble may be very easily corrected by a small rheostat in the lamp circuit or by variable taps on the transformers.

MEMBER: How do the a-c. carbons compare in price with the present d-c., low-intensity carbons?

Operating Costs

MR. GEIB: The operating cost of the new a-c. projector trim will be a little over 50 per cent higher than it is with the present low-intensity, d-c. trim, but this cost is just about one-half that of Hi-Low operating cost. The improvement in intensity and color of light with the new a-c. arc far more than offsets the slight increase in operating expense.

MR. RICHARDSON: It was extremely difficult for projectionists to maintain steady screen illumination with the old style a-c. arc; the craters were small and difficult to handle. Will this trouble

(*Continued on next page*)

TABLE III

Comparative Screen Light from Alternating-Current and Direct-Current, Neutral-Cored Carbon Arcs with the Regular Mirror Arc Optical System

Carbons	Line Cur.	Line Volt.	Line Watts	Arc Cur.	Arc Volt.	Foot-Candles on Screen** Middle	Left	Right	Top	Bottom
7-mm. Pos. 5-mm. Neg. Neutral Core	9 d-c.	110	990	9 d-c.	50	21	20	19	20	21
32832–2	8 d-c.	110	680	34 a-c.	19	27	25	25	26	27

** Weston photronic cell.

TABLE IV

Performance of Alternating-Current Arcs with Large Currents

Carbons	Current	Volts	Average Line Watts*	Optical System	Screen Light Compared with SRA Carbons at 35 Amp., 55 Volt.	Line Watts
6-mm. a-c.	40–45	22–25	945	Regular Mirror Arc	60–70%	3500
7-mm. a-c.	60–65	23–26	1580	"	85–95%	3500
8-mm. a-c.	75–80	24–29	2130	"	115–150%	3500

* Transformer efficiency, 90 per cent.

S. M. P. E. CHICAGO CONVENTION

The Fall meeting of the Society of Motion Picture Engineers will be held at the Edgewater Beach Hotel in Chicago, October 16, 17 and 18, according to an announcement of the Board of Governors of the Society. Chicago is an ideal selection this year, according to the board, since members may visit the Century of Progress Exposition while attending the convention, and because of the unusually low transportation rates being offered.

A feature will be the announcement and inauguration of the newly elected officers of the Society.

HIGH FIDELITY INSTALLATIONS

Contracts for the installation of Photophone High Fidelity sound equipment in nine theaters, eight of them in New England, have been received by RCA Victor Co. The houses are, in Massachusetts: Kameo, Pittsfield; Arcadia, Portsmouth; State, Quincy; Auditorium, Lynn, and Strand, Lawrence. In Connecticut: Empire, New London, and Strand, Norwich. Also the Park, Nashua, N. H., and the Rialto, Poughkeepsie, N. Y.

TABLE V

Summary Table of Data

Lamp Type	Carbons: Positive	Carbons: Negative	Current Amperes	Arc Voltage	Line Watts	Screen Light Arbitrary Units Same Screen Size
High Intensity	16-mm. H. I.	7/16"–1/2" Orotip	145–150	75–80	16700–17300[1]	
High Intensity	13.6-mm. H. I.	3/8"–7/16" "	115–120	60–70	13200–13800[2]	110–190
High Intensity	11-mm. H. I.	5/16"–3/8" "	85–95	50–60	9800–10900[2]	
High Intensity (HiLo)	9 mm.	5/16" "	60–85	45–55	6900–9800[2]	80–140
Low-Intensity Reflecting Arc	12–13-mm. SRA	8-mm. SRA	28–42	55	3000–4600[3] 2000–2900[5]	60
Low-Intensity Reflecting Arc	10–13-mm. Reg. MA	7–10-mm. Reg. MA	16–30	55	1600–3450[3] 1100–2200[5]	40–60
High-Intensity Alternating Current	7–8 mm.	-	60–80	23–28	1450–2350[4]	40–85

[1] 115-volt line, with resistance between line and lamp.

[2] Either 115-volt line with resistance between line and lamp; or motor-generator set, 80 per cent efficient, delivering direct current at 90 volts to resistance and lamp.

[3] Either 115-volt line with resistance between line and lamp; or motor-generator set, 80 per cent efficient, delivering direct current at 85 volts to resistance and lamp.

[4] A-c. line with transformer, 95 per cent efficient.

[5] A-c. line with rectifier, 75 per cent efficient.

occur in any degree with the new a-c. carbons?

Mr. Downes: I do not want to say that there will be no trouble with this new arc system; but such difficulties as are encountered will be only those more or less minor annoyances commonly found in all projection systems. You certainly will not have the difficulties encountered with the old a-c. arc, as the new arc is entirely different.

Mr. Richardson: Another important consideration is the possible effect upon light tone. The old-style a-c. arc furnished a rather harsh light tone; and the light appeared to be very penetrating, much more so than light from a d-c. arc.

Mr. Downes: We have had many requests from the smaller theaters such as: "Can't you give us the same blue-white light the larger theaters have?" There seems to be a general consensus of opinion among the projectionists that the blue-white color is far more desirable than the other.

Mr. Richardson: Are those carbons ready for the market now?

Mr. Geib: Yes.

Mr. Richardson: What is the amperage of the two lamps?

Mr. Downes: The power consumption at the arc is the same; the one we are demonstrating consumes between 40 and 45 amperes at 18 volts.

EFFECT OF CURRENT VALUES ON LIFE AND EFFICIENCY OF EXCITER LAMPS

THE life of an exciting lamp is very short compared with the ordinary house lamps, due to the special design necessary. The amount of light reaching the photo-electric cell, after passing through the optical system with its slot, is small compared with the total light radiated by the lamp; and as there is no way to increase the amount of light other than to increase the brilliancy of the lamp, the filament has to operate at an extraordinarily high temperature.

A small increase or decrease in operating amperage changes the brilliancy of the light considerably, as is shown in the accompanying tables. To make these tables applicable to different types of lamps, the variation is given in terms of percentages.

The brilliancy of the light is determined by the temperature of the filament, and this temperature in turn depends upon the current. The table shows that even with the comparatively small reduction of 5% in the operating current, the drop in light output is 27%. This means that the corresponding gain has to be added in the amplifier of the sound system.

By comparing the percentage of light loss between various lamps operating at different voltages, we find that the life of the 10% overloaded lamp approximates only one-third the life of a similar lamp operated at rated voltage. These facts are well known and have resulted in many projectionists burning their exciter lamps slightly below the listed rating. A lower rating, however, gives equally poor results in the way of efficient performance, and it is for this reason that lamp manufacturers insist that their product be burned at the listed rating.

At high temperature the tungsten filament of an exciter lamp evaporates, and the higher the temperature the higher the rate of evaporation. This action is the cause of the discoloration of lamp bulbs, occasioning serious loss of light. Under normal operating conditions, the evaporation of tungsten from the filament reduces the diameter of the filament wire, resulting in a progressively higher filament temperature.

If, now, to maintain the volume of sound and offset the effects of discoloration the voltage is raised, the process of discoloration increases much more rapidly. Under these conditions it will be necessary to periodically increase the voltage, the effect of which will be to render the lamp useless within a very short time, either through excessive discoloration or a burnt-out filament.

These facts relative to proper exciter lamp operation are self-evident and can be checked by any projectionist right in his own theatre. The economies effected by departing from the standards set up by the manufacturer are indeed of a petty nature in comparison with the risks taken on the score of efficiency and safety.

Current	85%	90	95	100	105	110	115
Light	35%	52	73	100	134	182	240

Light output compared with operating amperes

Current	90%	95	97.5	100	102.5	105	110	115
Life	380%	240	160	100	56	30	10	5

Life of lamp compared with operating amperages

NRA AND WHAT IT MEANS TO THE PROJECTIONIST

James J. Finn

NUMEROUS requests for information reflect the interest of projectionists throughout the United States in the probable effect of the National Recovery Act upon wages and conditions in the projection field. Most of the inquiries received by INTERNATIONAL PROJECTIONIST indicate a complete misunderstanding of the true purpose of NRA—what it is, what it seeks to accomplish, and how various sections of the Act will be administered so as to make possible a full realization of the objectives sought after.

The objectives of NRA are as clear-cut as a good diamond should be: the essential purpose of the Act is to shorten hours of work so as to spread employment and to insure the payment of a minimum wage which will enable even the unskilled worker to live decently and to buy a few things over and above the bare necessities of life. Insofar as those much-discussed "fair competition" sections of the Act are concerned, it can safely be assumed that the NRA does not permit the placing of a governmental stamp of approval on any set of "fair practices" within an industry that has not first provided for fair practices for its workers.

The core of the Act is the labor section, an excerpt from which follows:

Sec. 7. (a) Every code of fair competition, agreement, and license approved, prescribed, or issued under this title shall contain the following conditions: (1) That employees shall have the right to organize and bargain collectively through representatives of their own choosing, and shall be free from the interference, restraint, or coercion of employers of labor, or their agents, in the designation of such representatives or in self-organization or in other concerted activities for the purpose of collective bargaining or other mutual aid or protection; (2) that no employee and no one seeking employment shall be required as a condition of employment to join any company union or to refrain from joining, organizing, or assisting a labor organization of his own choosing; and (3) that employers shall comply with the maximum hours of labor, minimum rates of pay, and other conditions of employment, approved or prescribed by the President.

(c) Where no such mutual agreement has been approved by the President he may investigate the labor practices, policies, wages, hours of labor, and conditions of employment in such trade or industry or subdivision thereof; and upon the basis of such investigations, and after such hearings as the President finds advisable, he is authorized to prescribe a limited code of fair competition fixing such maximum hours of labor, minimum rates of pay, and other conditions of employment in the trade or industry or subdivision thereof investigated as he finds to be necessary to effectuate the policy of this title, which shall have the same effect as a code of fair competition approved by the President under subsection (a) of section 3. The President may differentiate according to experience and skill of the employees affected and according to the locality of employment; but no attempt shall be made to introduce any classification according to the nature of the work involved which might tend to set a maximum as well as a minimum wage.

The foregoing sections *are* the National Recovery Act—so much so that when NRA was gathering steam some weeks ago its deputy administrators acted more like organizers for the American Federation of Labor than Federal officials. With the formulation of the automobile code, this stiff-necked attitude in favor of Labor was modified somewhat, and at present it looks very much as though Labor will have to fight for every advantage it gains.

"Company Unions"

The latest manifestation of American industrial genius is the appearance of the "company union," despite the fact that the labor sections of the NRA included in this article specifically outlaw such organizations. A case in point now exists in New York where within the past three weeks an exhibitor organization has formed an operators group, obviously in the futile hope that this "union" would be recognized at the code hearings.

What will NRA mean to me? is the question uppermost in projectionists' minds. The answer is, as I see it, that NRA will mean the establishment of a maximum work week for projectionists, a minimum wage scale for a given work week, and the setting up of a plan which will have for its object the clearing of the benches of unemployed in certain Locals. This last-named objective may provide a knotty problem for more than one locality where there exist large numbers of unemployed.

Simple, one might say; but the answer is not as simple as it looks.

A maximum work week and a minimum wage are of little importance in considering a code for projectionists. Wages *and conditions* always have been the answer to projectionist security, and this answer holds doubly true at this time. One-man vs. two-men shifts looms up as the basis for a sizzling fight in Washington at the code hearings. A high wage and a poor condition (such as one-man shifts), means nothing to projection-

Labor Section of Proposed Code

Maximum Hours of Employment in Connection With Theatre Operation

Ten (10) days after approval of this Code by the President:

No person under sixteen (16) years of age shall be employed.

No employee of any department shall work for more than fifty-two (52) hours in one week.

The maximum hours prescribed in the foregoing paragraph shall not apply to contract labor, to professional persons employed in their professions, or to employees in a managerial or supervisory capacity.

Whenever it may be necessary because of an emergency, overtime and extra shifts beyond the limitations herein set forth shall be permitted.

Classifications of Employees

Employees shall be classified as follows:

Class No. 1—Operators.

Class No. 2—Stage Hands.

Class No. 3—Musicians.

Class No. 4—Ticket sellers, doormen, apprentices and office help.

Class No. 5—Ushers, office boys, cleaners, matrons watchmen and attendants.

Class No. 6—Other employees such as electricians and carpenters (not stage hands) painters, show card writers, sign painters.

Class No. 7—Professional persons and persons in managerial, executive or supervisory capacities.

Minimum Wages

Classes No. 1-2-3—Contract labor. These classes are matters for local autonomy and no minimum is fixed for them other than 40 cents per hour as prescribed in the President's agreement for mechanical employees.

Class No. 4—25 cents per hour in towns or cities having a population of 250,000 or less; 30 cents per hour in cities having a population between 250,000 and 500,000, and 35 cents per hour in cities having a population in excess of 500,000.

Class No. 5—25 cents per hour.

Class No. 6—This class shall be paid at hourly rates prevailing in the community in which the theater is located, provided, however, no less than 40 cents per hour shall be paid.

Class No. 7—The foregoing hours shall not apply to persons embraced in this class.

ists. A projectionist's first consideration of any approved code should be for conditions.

I believe that one-man operation has failed to justify itself, although I am aware that in certain sections of the United States one-man operation of a projection room is accepted practice. I believe that a vigorous stand in favor of two-men operation should be made by projectionist representatives at the Washington hearings. I think that this condition can be had, irrespective of what sections of this country have permitted the one-man shift. Much loose talk is heard about giving the smaller theatres the one-man shift, and the larger theatres the two-men shift. This is sheer nonsense, as the size and type of theatre has absolutely no bearing on the question of one-man vs. two-men operation. Two operating projectors, and accessory equipment, require two men.

Wages is not expected to be a controversial topic at Washington. The stagehands obtained recognition of the fairness of their scale of wages as of July 1 last, and there is no reason why projectionist scales as of some similar date should not be recognized —plus, of course, any special reduction given only for the summer period. Good conditions are the cornerstone of any acceptable projectionist code, and projectionist representatives at the Washington hearings should insist upon good conditions—throughout the country! The mere fact that Oscaloosa or Podunk today is operating on a one-man basis doesn't mean that this basis cannot be changed.

It should not be forgotten that one-man operation in a given territory positively constitutes unfair competition when another exhibitor in the same territory is using two-men shifts. This angle would take the matter of manpower out of the labor section.

Important Exhibition Practices

Projectionists are vitally interested in still another section of the proposed code—that relating to the barring of double features and the use of premiums. This statement may occasion the arching of eyebrows in certain quarters, but in this instance the interests of projectionists lie directly with the interests of the independent theatre owners. The elimination of double features is certain to result in the closing of many theatres, with resultant unemployment of projectionists. The barring of premiums, or giveaways of any kind, also will remove another weapon from the armory of the small independent exhibitor, who is hard pressed to compete with the larger and better appointed theatres.

Another evil against which projectionist representatives should take a firm stand is the practice of overbuying, indulged in by practically all of the larger houses, which is held responsible for the unemployment of at least 500 projectionists throughout the past year. When a circuit house, with producer connections, overbuys film the result in many instances is that the next fellow in line is at a terrific disadvantage. Overbuying is very much the concern of projectionists.

Thus, Labor must fight for itself in the matter of conditions—uniform conditions throughout the country—and it certainly should stand with the independent exhibitor in the fight to retain double features and premiums, and to eliminate the overbuying evil.

Local 306 Asks Removal of Blue Eagle from N. Y. Theatres

IN a surprise move only a few days in advance of the general hearing on the motion picture code, scheduled for September 12 in Washington, Harry Sherman, president of Local 306, demanded that NRA officials remove the Blue Eagle from certain New York City theatres which had supplanted 306 men with members of an organization known as Allied Moving Picture Operators Union, termed by Sherman a strictly company union. The case is notable by reason of its being the first to provoke a controversy centering around the collective bargaining sections of the Recovery Act.

Sherman carried his complaint direct to NRA officials in Washington, who immediately ordered a thorough investigation by New York NRA headquarters. The latter, acting upon formal complaints submitted by Local 306, summoned representatives of both the union and the exhibitors to a conference at which the various charges were thoroughly aired. Subsequently the NRA sent out into the theatre field a staff of investigators to check upon the conditions prevailing in those theatres referred to in the 306 complaint.

In the complaint Sherman charged that the exhibitors had committed two distinct violations of the National Recovery Act: (1) by forming a company union (Allied), they were flaunting the collective bargaining section of NRA, and (2) by working projectionists from 60 to 70 hours per week, subsequent to having signed the President's blanket code. Sherman submitted to New York NRA officials documentary evidence in support of his charges, including receipts for dues given by the exhibitors to projectionists and copies of a "yellow dog" agreement which every man seeking employment was asked to sign before he was put to work by the exhibitors.

The case created a sensation in New York City, with the newspapers giving generous space to a detailed account of the hearings, particularly with respect to that section of the complaint referring to the company union activities of the employers. Although the exhibitors denied the 306 charges, the nature of the evidence submitted by Sherman was such as to substantiate the allegations.

It is generally agreed that Sherman's action in filing the complaint in advance of the general code hearings in Washington was a smart move and one that is calculated to improve greatly the projectionists' position at the hearings. By focusing attention upon the company union aspects of the Allied Union, which point was given much attention by the newspapers, and by discrediting the exhibitors organization which, it is charged, not only formed its own union but also fixed the hours of work, Sherman has gained a heavy advantage.

Picketing Operations

Another interesting angle of the case was the action of Local 306 in assigning pickets to every theatre which ousted its men, despite the fact that all such theatres were flying the Blue Eagle. One week previously in a similar case the New York NRA officials had taken the stand that picketing of an establishment which flew the Blue Eagle was inconsistent with the Act and was not in spirit with the agreement reached between NRA officials and labor leaders. However, the 306 pickets were not molested, despite strenuous protests by exhibitors. Almost simultaneously, a New York Supreme Court Justice handed down a decision which enjoined the Bakers Union from picketing business places which, although flying the Blue Eagle, had discharged the union bakers. This decision aroused the ire of William F. Green, A. F. of L. leader, who announced in Washington that the entire resources of his organization would be aligned in back of the Bakers Union in an effort to win the right of picketing for any bona fide labor organization which sought to win better conditions for its members. New York newspapers were practically unanimous in the opinion that the ban against picketing would be lifted on appeal to a higher court.

Picketing of Blue Eagle businesses

is expected to present a particularly knotty problem for NRA officials, as any business flying a Blue Eagle is assumed to have subscribed to a code of fair practices with respect to labor. Such matters probably will be settled by NRA local representatives, instead of being carried to Washington.

A. F. of L. CONVENTION TO SETTLE STUDIO FIGHT

THE West Coast fight between the I. A. and I. B. E. W. has been "settled" through the medium of referring the matter to the forthcoming A. F. of L. Convention. The "settlement' provided for the immediate rehiring of all strikers pending ruling on the jurisdictional dispute—that is, "when a vacancy occurs." The effect of this latter phrase is to keep in the studios the men who displaced I. A. workers, because the studio has absolute control over the "occurrence of vacancies." Some of the West Coast I. A. men solved the problem presented by this ruling by immediately affiliating with the I. B. E. W. and thus becoming the holders of two cards.

I. A. officials present in Washington when the decision of the Labor Board was announced protested vigorously and immediately started to prepare for the impending battle on the floor of the A. F. of L. Convention. While it is an open secret that the A. F. of L. has not settled decisively any jurisdictional dispute submitted to it within the past 20 years, it is felt that the I. B. E. W. will force the issue this time, culminating its efforts of many years to wrest motion picture work from the I. A. Those who know intimately the workings of the A. F. of L. inner circle are convinced that the least the I. B. E. W. can get out of the fight is a "gift" of studio work. Theatre maintenance work, already handled by I. B. E. W. in certain cities, and projection room operation are considered as certain to be retained by the I. A.

No Unity on Coast

It is understood that the I. A. has already circularized every I. A. Local with a full report of the developments in the case, with which is tied up an appeal for hard work by every I. A. local in lining up votes for the impending convention fight. The action of the I. B. E. W. in seeking to wrest amusement field work from the I. A. is characterized in the circular as an unprecedented "double-cross" by a sister international. The language throughout the statement referring to the I. B. E. W. is unusually strong.

One of the most interesting sidelights to the whole affair is the lack of unity and cohesion displayed by the West Coast I. A. units. Wholesale desertions of I. A. Locals by their members are known to have occurred, with the pro-

ducers being able to announce two days after the strike began that not less than 120 cameramen had returned to work, in defiance of their leaders' instructions. Sound men, particularly, are said to have immediately opened negotiations looking toward affiliation with the I. B. E. W. At one big Hollywood opening, which required the services of projectionists, stagehands, carpenters, sound men, cameramen and others, every man on the job is reported to have held cards in at least two internationals.

I. B. E. W. headquarters in Washington kept quiet and looked wise, in sharp contrast to the numerous spirited statements issued by I. A. officials, and this attitude was interpreted by close observers as indicating the I. B. E. W.'s feeling of confidence as to the final outcome. Within the A. F. of L. the I. B. E. W. is much better situated than the I. A., commanding more votes and enjoying more prestige. Also, an I. B. E. W. official is a member of the A. F. of L. Council.

While the I. B. E. W. has for years taken the stand that its members are entitled to projection room work, it is felt that this phase of the dispute will be worked over by I. B. E. W. more as a talking point or as the basis for a compromise. No one expects that the I. B. E. W. will emerge from the fight with jurisdictional rights extending beyond the studios, despite the large number of I. B. E. W. men presently holding motion picture operating licenses.

RECENT ADVANCES IN ART OF TELEVISION

TELEVISION has been the beneficiary of extensive favorable publicity within recent weeks in both the technical and newspaper press, with particular emphasis having been laid upon the probable effect of this baby science upon the entertainment world, including motion pictures and radio, as at present constituted. Two of the most interesting statements anent television are appended hereto in abstract form, the first being taken from an article, "Electrical Transmission of Pictures," which appeared in *The Index* published by the New York Trust Company, as follows:

Television, according to the definition adopted by the Institute of Radio Engineers, is "the electrical transmission and reception of transient visual images." It might be added that the transmission and reception are practically simultaneous. Television in the United States today is exclusively experimental.

30 *U. S. Stations Operating*

The first public demonstration of television was given in 1925 and consisted of sending outlines of simple subjects. It was not until January 27, 1926, that J. L. Baird, before the Royal

Institution in London, transmitted real images of a living human face by electrical means. Progress since that time has been slow and gradual, but none the less effective. There are in the United States today about thirty television stations, some of them operating on regular schedule, and it is estimated that there are about 25,000 receiving sets, mostly in the hands of amateurs.

It may be said that television converts light waves into electrical impulses for transmission by radio just as the microphone converts sound waves into impulses for similar transmission. The method in use today is indicated briefly:

A scanning machine converts the scene or object, which is under the glare of a brilliant light, into an orderly succession of picture elements of a rapidly rotating disk having a number of systematically spaced apertures. The whole field of view is scanned by one complete revolution of the disk and the light waves breaking through the apertures are converted into a sequence of electrical impulses of proportionate intensity by a photoelectric cell. The impulses are then transmitted and received by wire or radio in the same manner as any other signals.

Upon reception, they effect the proportionate amount of light emitted by a lamp of special design, the rays of which are directed through a scanning disk, the duplicate of and operating at exactly the same speed as that in the sending station. Focused on a screen, the light reproduces the original scene in the form of moving pictures.

This, in an elemental way, is the process generally used in television today. Some of the steps may vary in different systems and all of them are subject to constant experimentation. Possibly few of them will remain the same by the time television is made available to the average person.

Many Obstacles

Before television is perfected, there are many obstacles to overcome. Since experimentation is costly and there is no immediate return from the expenditures, research work in many laboratories is being retarded. Some of the larger companies with regular research departments, however, are continuing their work unabated.

The seven major problems to be solved, according to Mr. Edwin K. Cohan, technical director of the Columbia Broadcasting System, are:

1. Greater detail of picture, made possible by an improved scanning system that will increase the number of lines far higher than sixty, the present standard.

2. A superior photoelectric cell or "eye," so sensitive that it will "see" scenes in natural light.

3. Increased luminosity at the receiver to project larger pictures in an undarkened room.

4. Removal of the current limitation of transmitting medium by selection of a wave-band in the ethereal spectrum where a wide pathway may be devoted to television.

5. Establishment of wires suitable to carry moving pictures or short waves, so a television network can be organized.

6. A source of light at the receiver that is not dangerous, difficult to handle nor expensive.

7. Design of a practical, simplified, foolproof receiver retailing at a reasonable price.

Perfection Necessary

The industry is not anxious to introduce receiving sets on the market until a greater degree of perfection is attained. From a curiosity viewpoint, modern television is probably as well developed as the early radio receiving sets, but the value of such curiosity is

discounted. The public has been educated to expect excellent radio reception and has become accustomed to a high standard in talking motion pictures so that placing television sets on the market under present conditions, would, it is believed, tend to retard the fullest exploitation of the market once an efficient set is developed.

When this is achieved, the entertainment and educational habits of the American people will be radically changed, Mr. Cohan believes. The whole technique of the studios, involving the stage settings, makeup and the personal appearance of the artists, must undergo an evolution. In the

radio broadcasting studio, it matters little how the furnishings are arranged or how the artist appears. With television, the atmosphere of the stage will prevail.

The uses to which television will be put are subject to the most varied speculation. Actual events, such as the inauguration of a President, athletic contests and ceremonies of all kinds, will be televised for the vast audiences that today enjoy such spectacles only in sound reproduction. Talking motion pictures will most probably be made of the same event and later in the day or at some subsequent date they will be used to reproduce the action and sound for television audiences.

It may be possible to use television for the transmission of such business transactions as signing checks and contracts, making announcements, and introducing and advertising products of various kinds. This may require important reconsiderations and interpretations of the law.

Another interesting statement is the following contribution to the correspondence section of *The Photographic Journal* (London, England):

Your report of the Television demonstration gives one the impression that, in this connection, photography is of almost no importance. This, however, is far from being the case; photography has assumed an importance it would hardly be possible to overestimate, since by the use of film most of the difficult problems atached to high resolution Television services are largely solved.

There are many reasons why transmission from film is preferable to beam, or "flying spot" scanning of the living "Televisee"—if I may use such a word. Of these the principal are:—

(1) A considerable reduction in the cost of the transmitting apparatus. It enables the replacement of a large number of enormous photo-electric cells, of which the cost is appalling, by a single cell of the normal type, familiar to those using "talkie" apparatus or modern density meters.

(2) As the initial technique in the studio is merely that of the film, the subject can be properly lighted, and, moreover, he or she is not distressed by the wandering light spot, which, at times, is apt to be somewhat dazzling.

(3) To make the most efficient use of the light reflected in the beam scanning method, the photo-electric cell or cells must be near to, or surround, the exploring beam. The image transmitted is therefore intolerably flat, and quite lacking in any suggestion of the third dimension. In contrast to this, a film is easily lighted from any azimuth to suggest roundness or planar recession as may be desired.

(4) "Make-up" problems are non-existent; since the record for transmission is a scale of gray densities the photo-electric cell has no color variations to deal with. Any "make-up" necessary is therefore that associated with film technique, which, of course, is well known and thoroughly understood.

(5) The transmitter is simpler, and, optically, much more efficient. It is also much easier to deal with "presentation" difficulties, such as the change from a close-up head to a full length. This is readily done by changing the lens on a film camera, and which can just as readily deal with fades in or out, or, if necessary, transmit titles.

The Sound Accompaniment

(6) Sound. In regard to the presence of a sound track on the film, opinion appears to be divided, mainly on the question of quality. But there is no doubt that a sound track on the film tends further towards a compact transmitter and a reduction of its cost.

These are a few of the reasons why photography is of importance in Television—an importance which will grow with the passage of time. At the present time in Germany the filming and transmission are almost simultaneous. The exposure is made with a slightly modified camera, after which the film is rapidly developed and fixed. It then passes into the Television transmitter proper, the reversal from the negative to the positive image is affected electrically.

In conclusion, there appears to be some rivalry between Germany and America in the reduction of the time necessary for the development and fixation of the film. It is definitely known, that in Germany, these processes have been carried out in thirty seconds, but, in a clipping, I see that America claims that it can be done in ten seconds! So far I have seen nothing in the photographic press relative to this rapid development fixation technique.

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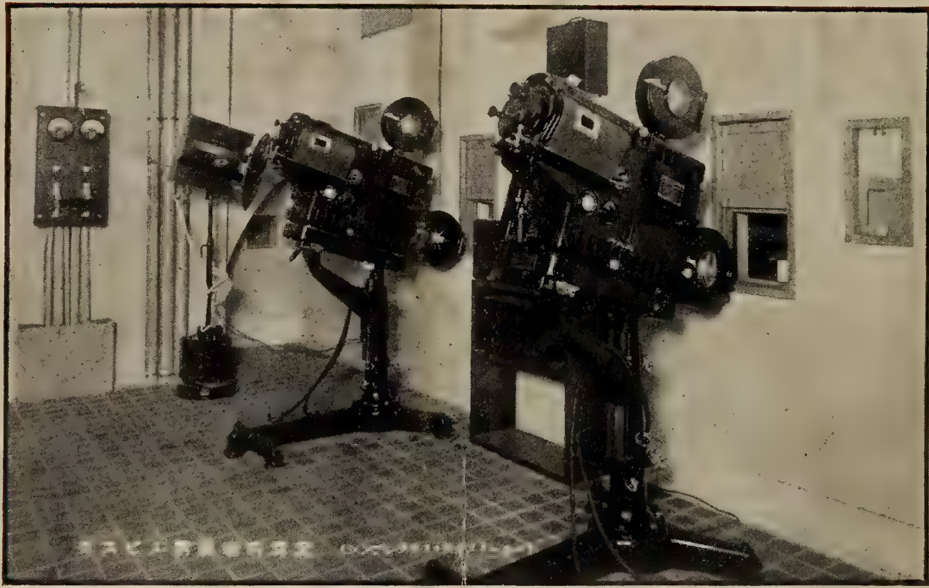

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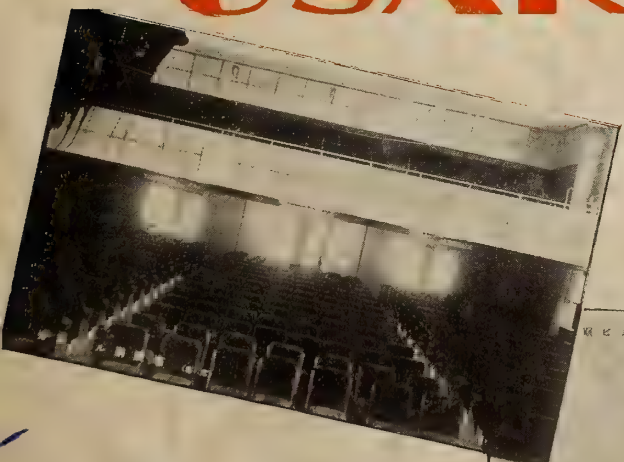

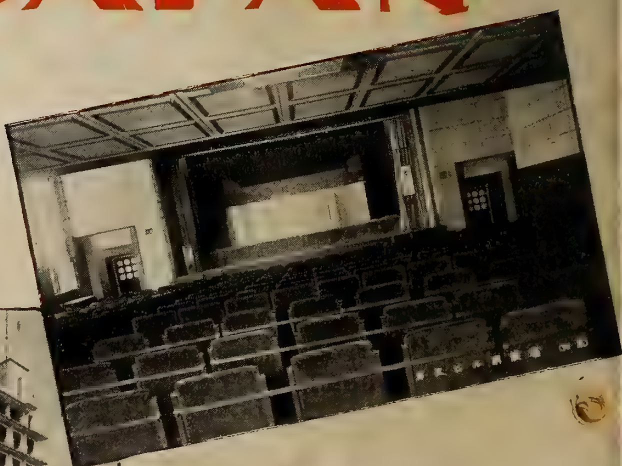

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